Lingcod Hook and Line Survey in the Gulf Island Region (Statistical Area 17) of the Strait of Georgia, October - December 1985

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April 1987

Canadian Manuscript Report of
Fisheries and Aquatic Sciences
No. 1934

Fisheries and Oceans Pêches et Océans

Canada

88-00940/

Canadian Manuscript Report of Fisheries and Aquatic Sciences

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by

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Cat. No. Fs 97-4/1934E ISSN 0706-6473

Correct citation for this publication:

Cass, A. J. and L. J. Richards. 1987. Lingcod hook and line survey in the Gulf Island region (statistical area 17) of the Strait of Georgia, October-December 1985. Can. MS Rep. Fish. Aquat. Sci. 1934: 65 p.

ABSTRACT

Cass, A. J. and L. J. Richards. 1987. Lingcod hook and line survey in the Gulf Island region (statistical area 17) of the Strait of Georgia, October-December 1985. Can. MS Rep. Fish. Aquat. Sci. 1934: 65 p.

A lingcod hook and line survey was conducted in the Gulf Island area of the Strait of Georgia during October-December 1985. The purpose of the survey was to compare research CPUE with the CPUE determined from sales records of the commercial hook and line fishery. This report presents an analysis of the first year of a proposed 3-yr study. We tested the effects of fishing method, depth, sea condition, cloud cover, time of day, current and tide on CPUE. Fishing method and depth had a significant effect on CPUE for lingcod and rockfish. All other factors had an insignificant effect on CPUE. A higher proportion of lingcod and larger lingcod and rockfish were caught by the commercial fishing method. Depth had a significant effect on species composition but not on the size of lingcod.

RESUME

Cass, A. J. and L. J. Richards. 1987. Lingcod hook and line survey in the Gulf Island region (statistical area 17) of the Strait of Georgia, October-December 1985. Can. MS Rep. Fish. Aquat. Sci. 1934: 65 p.

D'octobre à décembre 1985, un relevé de la pêche à la ligne de la morue-lingue a été effectué dans la région des îles Gulf du détroit de Géorgie. On visait la comparaison entre les PUE expérimentales et les PUE déterminées d'après les bordereaux d'achat des captures commerciales à la ligne. L'analyse présentée porte sur les résultats de la première année d'une étude proposée de 3 ans. On a vérifié l'incidence de la méthode de pêche, de la profondeur, de l'état de la mer, de l'ennuagement, du moment de la journée, du courant et de la marée sur les PUE. On a ainsi découvert que la méthode de pêche et la profondeur influent fortement sur les PUE de morue-lingue et de sébaste. Tous les autres facteurs avaient une incidence négligeable sur les PUE. Un plus grand nombre de morues-lingues et de gros sébastes et morues-lingues ont été capturés par les pêcheurs commerciaux. La profondeur avait une incidence importante sur la composition spécifique mais non sur la taille de la morue-lingue.

INTRODUCTION

Lingcod (Ophiodon elongatus) have been commercially exploited in the Strait of Georgia by hook and line since the early 1900s (Ketchen et al. 1983). Landings by other commercial fishing methods from the Strait of Georgia have been comparatively small (i.e. averaging less than 50 t/yr since 1970). The records collected by the Canadian Department of Fisheries and Oceans are the only source of statistics for the commercial hook and line fishery. Since 1967, these records have been stored on magnetic tape and include information on the landed weight and days fished by Statistical Area. The catch-per-unit-effort (CPUE) determined from these data has been used to assess the state of the lingcod resource in the Strait of Georgia (Cass 1985). While the sales records are the most lengthy time-series of fishery statistics for the commercial hook and line fishery, the representativeness of these data as an index of abundance is not known.

In 1985 we began a study to compare the CPUE of lingcod from research fishing with the CPUE determined from sales records. The purpose of the study is to evaluate the representativeness of the latter for lingcod. Research hook and line CPUE has been shown to be an index of abundance for some nearshore reef species (Richards and Schnute 1986). In this report we present our analysis and results of a research hook and line survey of Statistical Area 17 conducted during November-December 1985. Similar surveys are proposed for 1986 and 1987.

METHODS

Fishing was conducted from the chartered 11-m commercial handline-troll vessel, the F/V BLACK HEART. The fishing crew consisted of two commercial fishermen and two research personnel. Fish were caught using two different angling techniques. Research personnel used a standardized method of angling developed during previous surveys in the Strait of Georgia (Richards and Cass 1985; Richards et al. 1985). This method employs the use of trolling rods and reels and frozen herring as bait. The fishing line was 9-kg test mono-filament with a 7-kg test leader. Mooching weights ranged from 113-227 g depending on the depth and current. Two single Mustad #92553 size 3/0 hooks with a 6-cm spacing were used on each line. Pre-frozen 12-cm bait herring were hooked through the snout and near the caudal fin. Commercial fishermen used handlines and live herring as bait. This is the most common commercial fishing method used to catch lingcod in the Strait of Georgia. Fishing lines consisted of a single 23-kg test monofilament and a steel leader with a 0.5-kg lead weight. A single Mustad #9550 size 8/0 hook was suspended from each line. Live 10-20-cm herring were hooked through the snout.

The survey design and fishing methods were similar to surveys conducted in other areas of the Strait of Georgia (Richards and Cass 1985;

Richards et al. 1985). Statistical Area 17 was divided into 1 min lat. x 1 min long. blocks. Blocks encompassing known lingcod fishing areas were identified by the vessel's skipper. Ten blocks were selected from a random numbers table as our fishing sites. Fishing at each site was stratified by depth ranges of 10-26 m (4-15 fa), 27-46 m (16-25 fa) and 47-55 m (26-35 fa). The 10-55 m depth range encompasses the depth ranges fished by commercial lingcod fishermen in the survey area.

The fishing position within each site-depth stratum was selected by the vessel's skipper from his knowledge of the distribution of lingcod. While we were fishing, the vessel was allowed to drift with the current until the vessel had moved out of the target area, or out of the site-depth stratum. At that point we stopped fishing until the vessel was re-positioned. Where commercially fished reefs extended beyond the boundaries of the blocks, fishing was continued to permit sampling throughout known lingcod areas in the vicinity of each block. Fishing positions within a site-depth stratum were changed according to the following:

1. If no fish were caught in the first 10 min.
2. If the CPUE declined, such that no fish were caught in the previous 10 min.
3. If the catch was predominantly dogfish.
4. If more than 10 fish of one species were caught.

We fished at each time-depth-site stratum for a minimum of 0.5 h unless the above conditions were not satisfied or because of poor weather conditions. We attempted to fish each stratum on at least two different days.

Fishing effort was defined as the sum of the fishing time recorded by each angler. Fishing time for each angler was measured by a stop watch and represents the time the bait was on or near the near bottom. The watch was stopped when a fish was hooked, when a bite occurred or when the gear became fouled on the bottom.

A catch was recorded whenever the fish was brought to a depth at which it could be identified to species. The landed catch of lingcod and rockfish were measured for fork length to the nearest mm, weighed to the nearest 0.1 kg and examined for sex and maturity condition. The 4th-8th second dorsal fin-rays were collected from lingcod and otoliths were collected from rockfish for age determination. Age readings will be reported elsewhere. The ovaries of lingcod were weighed and preserved for fecundity estimation. The temperature and salinity at depth were recorded using a conductivity-temperature-depth recorder (CTD).

RESULTS AND DISCUSSION

CRUISE SUMMARY

Ten sites were fished during October 28-December 11 1985 (Fig. 1). Except for sites 12 and 15, each site was fished on two separate days. The number of fish caught by species and the fishing effort were summed by fishing method for each time-depth-site stratum. Catch and effort data by fishing method for each stratum are presented in Appendix Table 1. The codes for cloud cover, sea condition, tide and current are described in Appendix Table 2. Length, weight, sex and maturity data for lingcod and rockfish are presented in Appendix Table 3. The maturity codes are described in Appendix Table 4.

CATCH RATES

Catch-per-unit-effort (CPUE) by fishing method for each species at each site and depth is presented in Table 1. CPUE ranged from 0.0 to 70.0 fish h^{-1}. The mean CPUE with one standard error was 10.6±1.2 fish h^{-1}. The mean CPUE for lingcod was 7.4±1.2 fish h^{-1}. The mean CPUE for rockfish was 2.7±0.5 fish h^{-1}.

Variations in CPUE may be due to a number of factors. We tested for the effects of fishing method, depth, time of day, cloud cover, sea condition, tide and current on CPUE. The effects of time of day, cloud cover, sea condition, tide, and current on CPUE were tested separately for each depth interval. Except for fishing method and depth, all factors had an insignificant effect on CPUE (Kruskal-Wallis tests; $p>0.05$).

The effects of fishing method and depth on CPUE are shown in Figure 2 and 3, respectively. In the tests for fishing method, lingcod CPUE was highest at all of the comparable sites using the commercial fishing method ($n=29$; sign test, $p<0.001$). Quillback rockfish (Sebastes maliger) CPUE was highest using our research method at 86% of the sites ($n=21$; sign test, $p<0.001$). Copper rockfish (S. caurinus) CPUE was highest using our research method at 82% of the sites ($n=11$; sign test, $p<0.03$). There was no significant difference between fishing methods for yelloweye rockfish (S. ruberrimus) CPUE ($n=7$; sign test, $p>0.5$). There was also a significant effect of depth on CPUE for most species. For lingcod there was a distinct gradient of declining CPUE with increasing depth (Kruskal-Wallis test, $p<0.001$). There was also a decline in the CPUE of copper rockfish with increasing depth (Kruskal-Wallis, $p<0.05$). The CPUE for yelloweye rockfish increased with depth. While sample sizes were small the difference was highly significant (Kruskal-Wallis test, $p<0.005$). For quillback rockfish the effect of depth on CPUE was not significant (Kruskal-Wallis test, $p>0.05$).

SPECIES COMPOSITION

The most abundant species caught were lingcod (70%), quillback rockfish (17%), copper rockfish (5%), yelloweye rockfish (3%) and spiny dogfish (Squalus acanthias) (3%). Combined catches of greenstriped rockfish (Sebastes elongatus), black rockfish (S. melanops), cabezon (Scorpaenichthys marmoratus), rock sole (Lepidopsetta bilineata), kelp greening (Hexagrammos decagrammus) and Pacific cod (Gadus macrocephalus) accounted for 2% of the total catch (Table 2). The species composition was dominated by lingcod across all three depth intervals. Quillback rockfish was the dominant rockfish species in the mid and deep depths. Copper rockfish was dominant in the shallow depth.

We tested for the effect of fishing method and depth on the proportion of lingcod and quillback, copper and yelloweye rockfish in the catch (Table 3). There were significant differences in species composition between the two fishing methods and among the three depth intervals (chi-square, $p<0.001$). Lingcod comprised the highest percentage of the catch across all depths using the commercial fishing method (Fig. 4). Quillback rockfish dominated the catch at the mid and deep depths using our research fishing method (Fig. 5).

SIZE COMPOSITION

Length-frequency histograms for lingcod and quillback and copper rockfish are shown in Figure 6. Weight-frequency histograms are shown in Figure 7. The mean length and weight of each species sampled is presented in Table 4 by fishing method and depth. We tested for the effects of fishing method and depth on the median size of lingcod, and copper and quillback rockfish. The effect of fishing method on the length and weight of all three species was significant (Wilcoxon signed-ranks test, $p<=0.01$). In all cases the mean length and weight was larger using the commercial fishing method (Table 4). There was no significant effect of depth on the length or weight of lingcod (Kruskal-Wallis test, $p>0.05$). However, quillback rockfish were significantly larger with increased depth (Kruskal-Wallis test, $p<0.005$) (Table 4).

Weight-length relationships for lingcod, quillback and copper rockfish are shown in Figure 8. Regression parameters are presented in Table 5.

MATURITY

For female lingcod, 60% of the number sampled (n=218) were mature. Of these, 50% contained ovaries with ova 1 mm in diameter (stage 4), 32% contained ovaries with ova < 1 mm in diameter (stage 3) and 15% contained ovaries with ova 1-2 mm in diameter (stage 5) (Table 6). Maturity ogives for

female lingcod are shown in Figure 9. The length at 50% maturity, estimated using probit analysis, was 64 cm (95% fiducial limits = 62-66 cm). The smallest mature female was 54 cm. The largest immature female was 79 cm. The size at maturity was similar to the size at maturity observed off the southwest coast of Vancouver Island in 1985 where the size at 50% maturity for females was 65 cm (Cass et al. 1986). For male lingcod, 98% of the number sampled (n=150) were mature. Of these, 61% contained testes that filled about two-thirds of the body cavity (stage 4) and 31% contained testes that filled less than one-quarter of the body cavity (stage 3) (Table 6). The smallest mature male was 42 cm. All males >51 cm were mature.

For combined sexes of quillback rockfish, 85% of the number sampled (n=75) were mature. Of the mature females, 78% contained stage 3 ova and 18% contained stage 4 ova. Of the mature males, 71% contained stage 4 testes and 14% contained stage 3 testes (Table 6). The maturity ogive for combined sexes of quillback rockfish is shown in Figure 10. Size at 50% maturity for quillback rockfish was 30 cm (95% fiducial limits=27-31 cm).

TEMPERATURE AND SALINITY

Temperature and salinity profiles for each site and date are shown in Figures 11 and 12 respectively. Temperatures ranged from 5.0°C at the surface to 9.0°C at 60 m. Except for sites 15 and 30, a prominent thermocline was present at about 20-30 m. Salinities ranged from 26.5 °/.. at the surface to 30.0 °/.. at 60 m. As with temperature, salinity profiles revealed a halocline at about 20-30 m.

ACKNOWLEDGMENTS

We thank Mr. J. Selsby for his participation in this study. We also thank the two commercial fishermen, Mr. T. Barnes and Mr. A. Crocker, for their advice and expertise during this survey. Mark Saunders reviewed the manuscript.

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TABLE 1. Summary of effort (h) and CPUE (fish h^{-1}) by site and depth during a lingcod research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28 - December 12 1985. Depth 1=5-27m, depth 2=28-45m and depth 3=46-55m. LC=lingcod, QB=quillback rockfish, YE=yelloweye rockfish, CO=copper rockfish, GS=greenstriped rockfish, BR=black rockfish KG=kelp greenling, CA=cabezon, DF=spiny dogfish, RS=rock sole and PC=Pacific cod.

SITE	DEPTH	EFFORT	LC	QB	CO	YE	GS	BR	KG	CA	DF	RS	PC	TOTAL
A. COMMERCIAL FISHING METHOD								CPUE						
3	1	2.73	16.46	-	-	-	-	0.37	-	-	0.37	-	-	17.20
3	2	0.90	3.33	-	-	-	-	-	-	-	-	-	-	3.33
3	3	1.50	8.67	-	2.67	-	-	-	-	-	-	-	-	11.33
7	1	1.83	25.09	-	-	-	-	-	-	-	-	-	-	25.09
7	2	0.33	6.00	-	-	-	-	-	-	-	-	-	-	6.00
7	3	0.50	4.00	-	2.00	-	-	-	-	-	-	-	-	6.00
12	1	0.50	38.00	-	-	-	-	-	-	-	-	-	-	38.00
12	2	0.90	8.89	1.11	1.11	-	-	-	-	-	6.67	-	-	17.78
12	3	0.33	12.00	-	15.00	-	-	-	-	-	6.00	-	-	33.00
13	1	0.40	27.50	-	-	-	-	-	-	-	-	-	-	27.50
13	2	0.83	14.40	-	-	-	-	-	-	-	-	-	-	14.40
13	3	0.80	1.25	-	1.25	-	-	-	-	-	-	-	-	2.50
15	1	1.03	20.32	-	-	-	-	-	-	-	-	-	-	20.32
19	1	1.50	4.00	-	-	-	-	-	-	-	-	-	-	4.00
19	2	2.10	2.38	-	-	-	-	-	-	-	-	-	-	2.38
19	3	1.13	-	-	-	0.88	-	-	-	-	-	-	-	0.88
27	1	4.53	14.12	0.88	-	1.10	-	-	-	0.22	0.44	-	-	16.76
27	2	1.37	19.02	4.39	-	-	-	-	-	-	-	-	-	23.41
27	3	1.93	1.55	1.55	-	-	-	-	-	-	-	-	-	2.59
30	1	1.57	18.51	-	-	-	-	-	-	-	-	-	-	18.51
30	2	1.30	10.00	-	0.77	-	-	-	0.77	-	-	-	-	11.54
51	1	2.57	3.51	-	-	-	-	-	-	-	-	-	-	3.51
51	2	2.53	1.18	1.58	-	0.39	-	-	-	-	0.79	-	-	3.95
51	3	0.47	-	2.14	-	-	-	-	-	-	4.29	-	-	6.43
53	1	1.33	3.75	-	-	-	-	-	-	-	-	-	-	3.75
53	2	1.37	2.93	2.20	-	-	-	-	-	-	-	-	-	5.12
53	3	1.20	2.50	-	-	-	-	-	-	-	-	-	-	2.50

TABLE 1 (cont'd)

SITE	DEPTH	EFFORT	LC	QB	CO	YE	GS	BR	KG	CA	DF	RS	PC	TOTAL
B. RESEARCH FISHING METHOD								CPUE						
3	1	0.80	1.25	1.25	-	3.75	-	-	-	-	-	-	-	6.25
3	2	1.00	-	-	-	-	-	-	-	-	-	-	-	0.00
3	3	0.57	-	1.76	-	-	-	-	-	-	-	-	-	1.76
7	1	0.57	3.53	3.53	-	-	-	-	-	-	-	-	-	7.06
7	2	0.30	-	3.33	-	-	-	-	-	-	-	-	-	3.33
7	3	0.50	2.00	2.00	-	-	-	-	-	-	-	-	-	4.00
12	1	0.53	3.75	9.37	-	-	-	-	-	-	-	-	-	13.12
12	2	0.50	-	2.00	-	-	-	-	-	-	4	-	-	6.00
12	3	0.67	4.50	9.00	-	-	-	-	-	-	-	-	-	13.50
13	1	0.25	4.00	-	-	16.00	-	-	-	-	-	-	-	20.00
13	2	0.90	-	5.56	1.11	-	-	-	-	-	-	-	-	6.67
13	3	0.33	-	-	3.00	-	-	-	-	-	-	-	-	3.00
15	1	0.40	-	17.50	-	-	-	-	-	-	-	-	-	17.50
19	1	1.43	0.70	4.19	-	1.40	-	-	-	-	-	-	-	6.28
19	2	1.03	-	-	-	-	-	-	-	-	-	-	-	0.00
19	3	1.27	-	-	-	-	0.79	-	-	-	-	0.79	0.79	2.37
27	1	1.87	2.68	5.36	-	2.68	-	-	-	-	-	0.54	-	11.25
27	2	0.43	-	23.08	-	4.62	-	-	-	-	-	-	-	27.69
27	3	0.70	-	-	-	-	-	-	-	-	-	-	-	2.86
30	1	0.50	4.00	-	-	-	-	-	-	-	-	-	-	4.00
30	2	0.67	-	-	1.50	-	-	-	-	-	-	-	-	1.50
51	1	2.33	0.43	-	-	-	-	-	-	-	-	0.43	-	0.86
51	2	1.87	-	3.75	-	-	-	-	-	-	-	-	-	3.75
51	3	0.47	-	-	-	-	-	-	-	-	-	-	-	0.00
53	1	1.23	-	-	-	3.24	-	-	-	-	-	-	-	3.24
53	2	1.00	2.00	6.00	-	1.00	-	-	-	-	-	-	-	9.00
53	3	1.00	-	2.00	-	-	-	-	-	-	-	-	-	2.00

TABLE 2. Species composition by site and depth during a lingcod hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28 - December 12 1985. Depth 1= 5-27 m, depth 2=28-45 m and depth 3=46-55 m. LC=lingcod, QB=quillback rockfish, YE=yelloweye rockfish, CO=copper rockfish, GS=greenstriped rockfish, BR=black rockfish, KG=kelp greenling, CA=cabezon, DF=spiny dogfish, RS=rock sole, PC=Pacific Cod and NF=number of fish.

SITE	DEPTH	LC	QB	YE	CO	GS	BR	KG	CA	DF	RS	PC	NF
3	1	0.88	0.02	-	0.06	-	0.02	-	-	0.02	-	-	52
3	2	1.00	-	-	-	-	-	-	-	-	-	-	3
3	3	0.72	0.06	0.22	-	-	-	-	-	-	-	-	18
7	1	0.96	0.04	-	-	-	-	-	-	-	-	-	50
7	2	0.67	0.33	-	-	-	-	-	-	-	-	-	3
7	3	0.60	0.20	0.20	-	-	-	-	-	-	-	-	5
12	1	0.81	0.19	-	-	-	-	-	-	-	-	-	26
12	2	0.42	0.11	0.05	-	-	-	-	-	0.42	-	-	19
12	3	0.35	0.30	0.25	-	-	-	-	-	0.10	-	-	20
13	1	0.75	-	-	0.25	-	-	-	-	-	-	-	16
13	2	0.67	0.28	0.06	-	-	-	-	-	-	-	-	18
13	3	0.33	-	0.67	-	-	-	-	-	-	-	-	3
15	1	0.75	0.25	-	-	-	-	-	-	-	-	-	28
19	1	0.47	0.40	-	0.13	-	-	-	-	-	-	-	15
19	2	1.00	-	-	-	-	-	-	-	-	-	-	5
19	3	-	-	-	0.25	0.25	-	-	-	-	0.25	0.25	4
27	1	0.71	0.14	-	0.10	-	-	-	0.01	0.02	0.01	-	97
27	2	0.59	0.36	-	0.05	-	-	-	-	-	-	-	44
27	3	0.43	0.43	-	-	-	-	-	-	-	-	-	7
30	1	1.00	-	-	-	-	-	-	-	-	-	-	31
30	2	0.81	-	0.13	-	-	-	0.06	-	-	-	-	16
51	1	0.91	-	-	-	-	-	-	-	-	0.09	-	11
51	2	0.18	0.65	-	0.06	-	-	-	-	0.12	-	-	17
51	3	-	0.33	-	-	-	-	-	-	0.67	-	-	3
53	1	0.56	-	-	0.44	-	-	-	-	-	-	-	9
53	2	0.38	0.56	-	0.06	-	-	-	-	-	-	-	16
53	3	0.60	0.40	-	-	-	-	-	-	-	-	-	5

Table 3. The effect of fishing method and depth on species composition during the lingcod hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28 - December 12 1985. Species with an expected frequency of less than 5 are excluded. For fishing method: com=commercial, res=research. For depth: 1=5-27 m, 2=28-45 m, and 3=46-55 m.

A. FISHING METHOD

	Species composition (%)				N
	LC	QB	CO	YE	
com	89.5	5.5	1.8	3.3	399
res	18.1	61.2	18.1	2.6	116
N	378	93	28	16	

chi-square=261, df=3, p<0.001

B. DEPTH

	Species composition (%)			N
	LC	QB	CO	
1	82.3	10.7	7.0	328
2	61.9	34.9	3.2	126
3	66.7	31.1	2.1	45
N	378	93	28	

chi-square=42, df=4, p<0.001

Table 4. Mean fork length (cm) and weight (kg) and one standard error (S.E.) by depth and fishing method for lingcod and rockfish sampled during the lingcod hook and line survey in the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28 - December 12 1985. For depth: 1=5-27 m, 2=28-45 m and 3=46-55 m. For fishing method: com=commercial, res=research.

A. MALE LINGCOD

DEPTH	N	MEAN LENGTH	S.E.	MEAN WEIGHT	S.E.
1	121	60.2	0.8	2.3	0.1
2	26	58.7	1.3	2.6	0.5
3	3	54.1	2.6	1.7	0.5

GEAR	N	MEAN LENGTH	S.E.	MEAN WEIGHT	S.E.
COM	141	60.2	0.7	2.4	0.1
RES	9	54.4	3.1	1.6	0.2

B. FEMALE LINGCOD

DEPTH	N	MEAN LENGTH	S.E.	MEAN WEIGHT	S.E.
1	144	67.9	1.0	3.6	0.2
2	26	58.7	1.3	2.6	0.5
3	26	69.7	2.6	3.9	0.5

GEAR	N	MEAN LENGTH	S.E.	MEAN WEIGHT	S.E.
COM	208	69.1	0.8	3.8	0.2
RES	10	57.2	5.8	2.5	0.8

C. QUILLBACK ROCKFISH

DEPTH	N	MEAN LENGTH	S.E.	MEAN WEIGHT	S.E.
1	26	32.2	1.0	0.8	0.1
2	43	35.9	0.6	0.9	0.1
3	14	37.4	0.9	1.0	0.1

GEAR	N	MEAN LENGTH	S.E.	MEAN WEIGHT	S.E.
COM	22	37.6	0.7	1.1	0.1
RES	61	34.1	0.6	0.8	0.04

Table 4 (cont'd)

D. COPPER ROCKFISH

DEPTH	N	MEAN LENGTH	S.E.	MEAN WEIGHT	S.E.
1	18	34.4	1.1	0.8	0.1
2	4	35.5	3.4	0.8	0.2
3	1	42.3	-	1.4	-

GEAR	N	MEAN LENGTH	S.E.	MEAN WEIGHT	S.E.
COM	7	39.9	2.0	1.1	0.2
RES	16	32.8	0.1	0.7	0.1

E. YELLOWEYE ROCKFISH

DEPTH	N	MEAN LENGTH	S.E.	MEAN WEIGHT	S.E.
1	0	-	-	-	-
2	2	48.5	0.1	2.2	1.1
3	12	49.5	2.8	2.2	0.4

GEAR	N	MEAN LENGTH	S.E.	MEAN WEIGHT	S.E.
COM	12	51.0	2.8	2.4	0.4
RES	2	40.1	0.2	1.2	0.03

Table 5. Parameter estimates for the weight-length regression: Log(Weight) = a + b * log(Length), where the weight is measured in grams and length is measured in millimeters for species sampled during the lingcod hook and survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28 - December 12 1985.

SPECIES	SEX	a	b	r^2	n
lingcod	male	-5.512	3.189	0.92	136
	female	-5.683	3.243	0.95	201
quillback rockfish	combined	-5.175	3.181	0.96	82
copper rockfish	combined	-4.680	2.972	0.96	22
yellowye rockfish	combined	-4.624	2.953	0.97	12

Table 6. Stages of gonad development for mature lingcod and rockish sampled during the lingcod hook and line survey of the Gulf Island region (Statistial Area 17) of the Strait of Georgia, October 28 - December 12 1985. A description of the codes are presented in Appendix Table 4.

A. LINGCOD MATURITY

STAGE	MALE %	MALE n	FEMALE %	FEMALE n
3	31.3	46	32.3	42
4	60.5	89	50.0	65
5	4.1	6	14.6	19
6	-	0	3.1	4
7	4.1	6	-	0

B. QUILLBACK ROCKFISH

STAGE	MALE %	MALE n	FEMALE %	FEMALE n
2	3.6	1	3.1	1
3	14.3	4	78.1	25
4	71.4	20	18.8	6
5	-	0	-	0
6	-	0	-	0
7	10.7	3		0

C. COPPER ROCKFISH

STAGE	MALE %	MALE n	FEMALE %	FEMALE n
2	-	0	100.0	13
3	14.3	4	-	0
7	85.5	6	-	0

D. YELLOWEYE ROCKFISH

STAGE	MALE %	MALE n	FEMALE %	FEMALE n
2	-	0	62.5	5
3	100.0	4	25.0	2
7	-	0	12.5	1

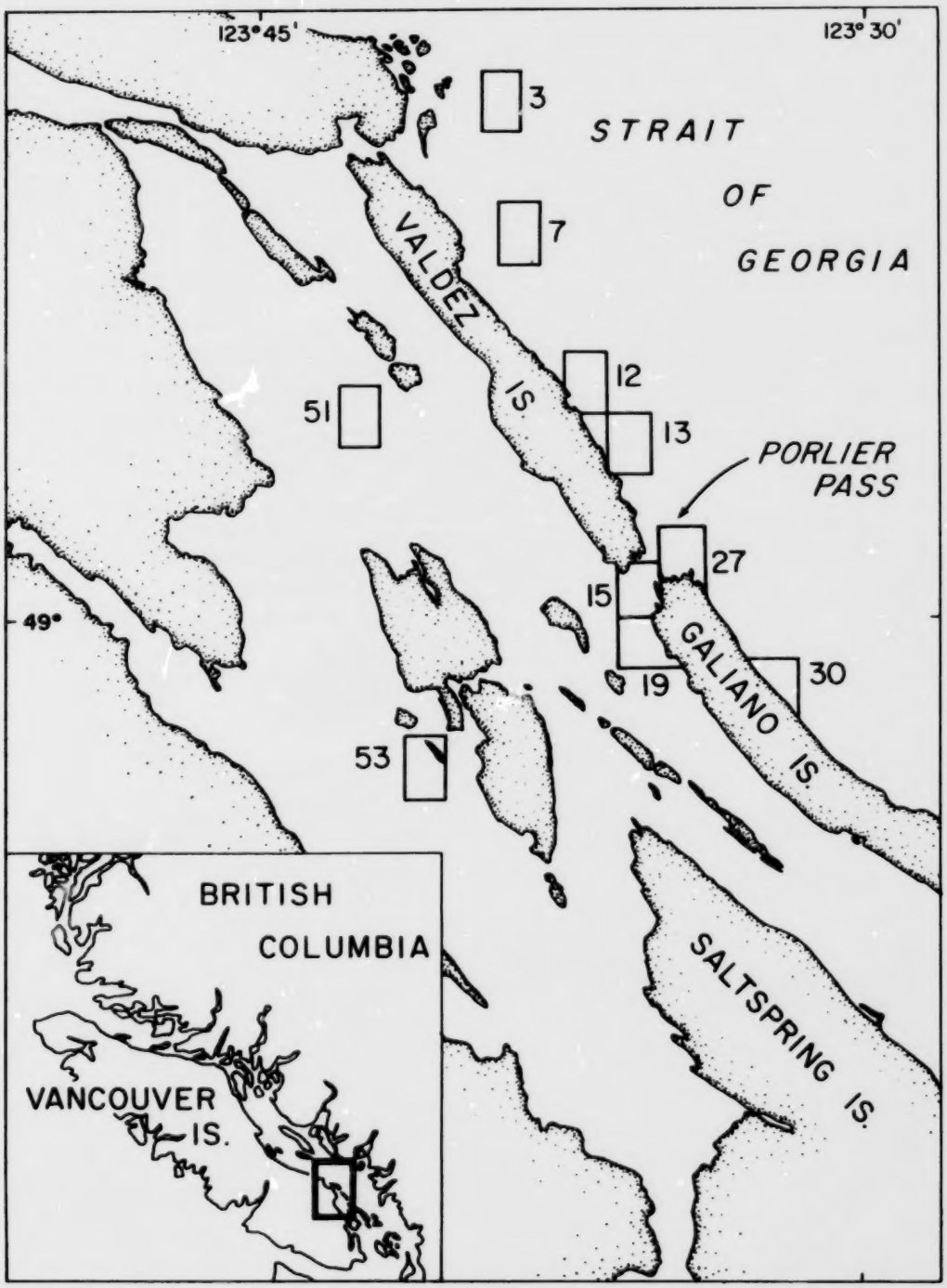


Fig. 1. Locations of fishing sites during a lingcod research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985.

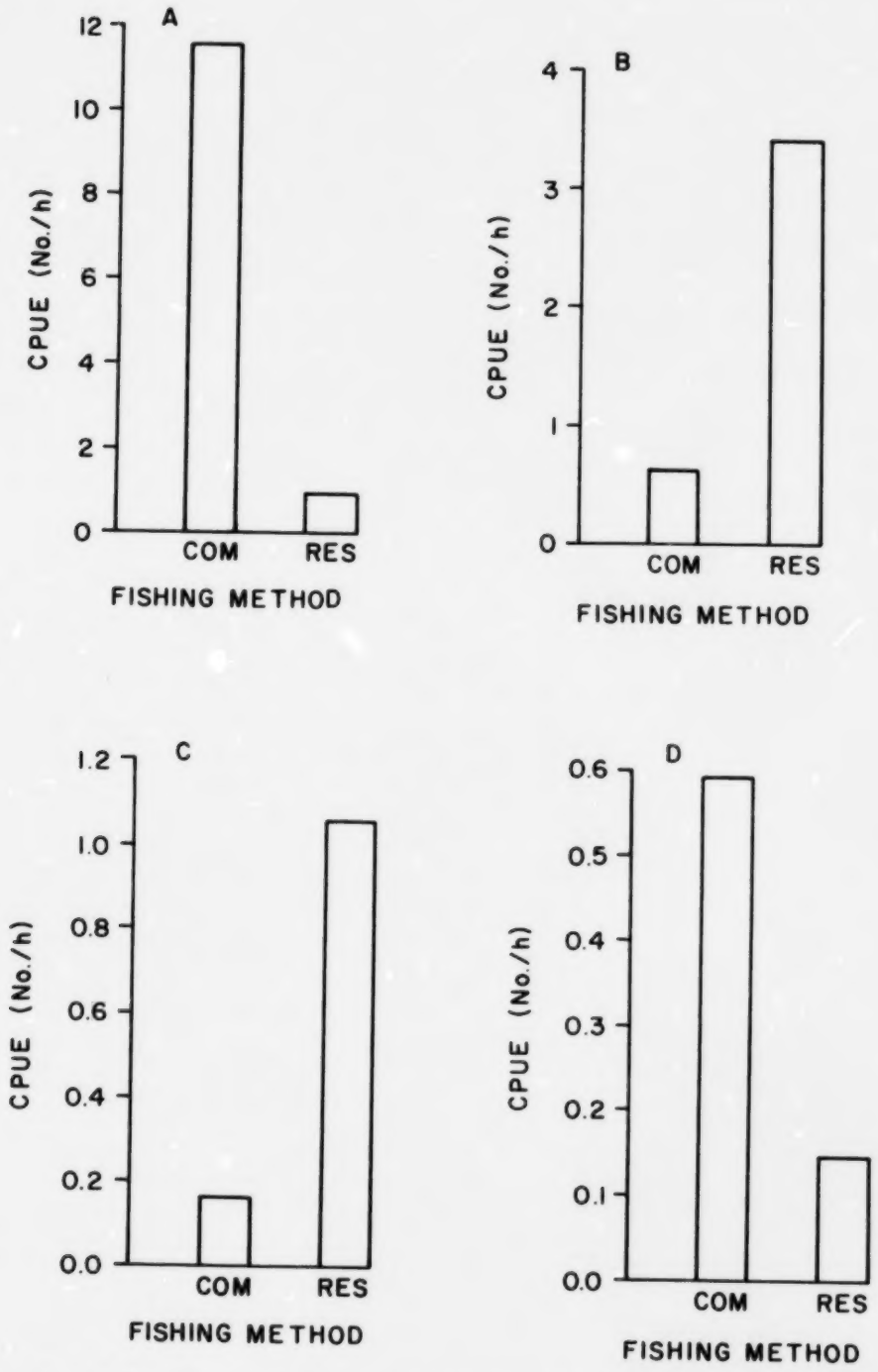


Fig. 2. Mean CPUE by fishing method for (A) lingcod, (B) quillback rockfish, (C) copper rockfish and (D) yelloweye rockfish during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985. COM = commercial fishing method, RES = research fishing method.

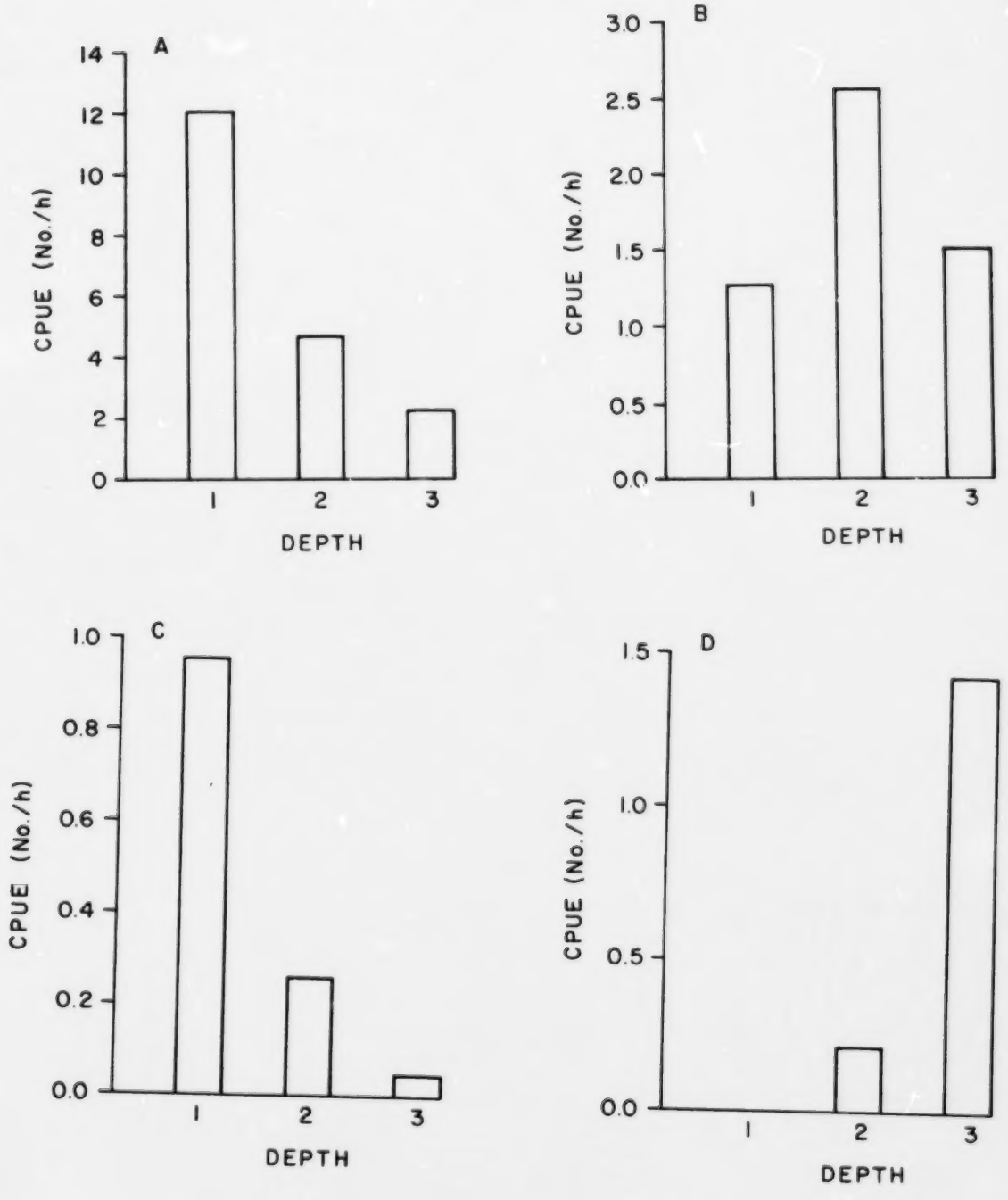


Fig. 3. Mean CPUE by depth interval for (A) lingcod, (B) quillback rockfish, (C) copper rockfish and (D) yelloweye rockfish during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985. For depth:1 = 5-27 m, 2 = 28-45 m and 3 = 46-55 m.

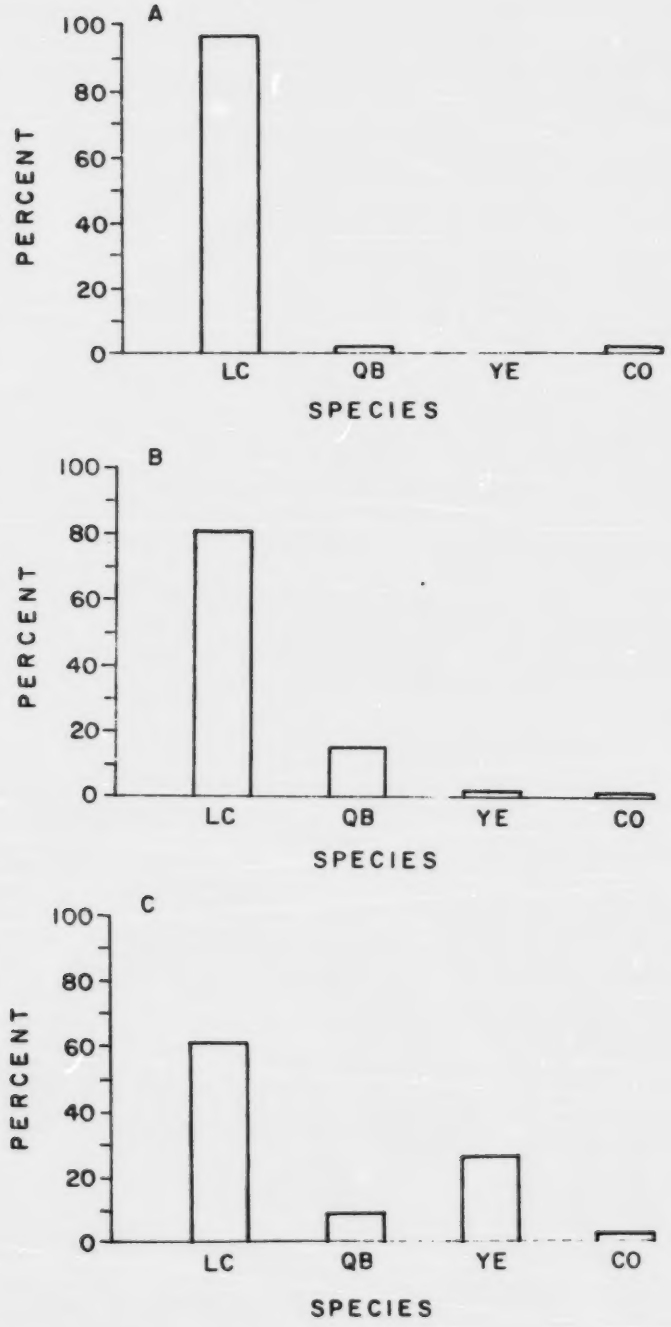


Fig. 4. The percentage of lingcod (LC), quillback rockfish (QB), yelloweye rockfish (YE) and copper rockfish (CO) in the catch during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985, using the commercial fishing method in (A) the 5-27 m depth interval, (B) the 28-45 m depth interval and (C) the 46-55 m depth interval.

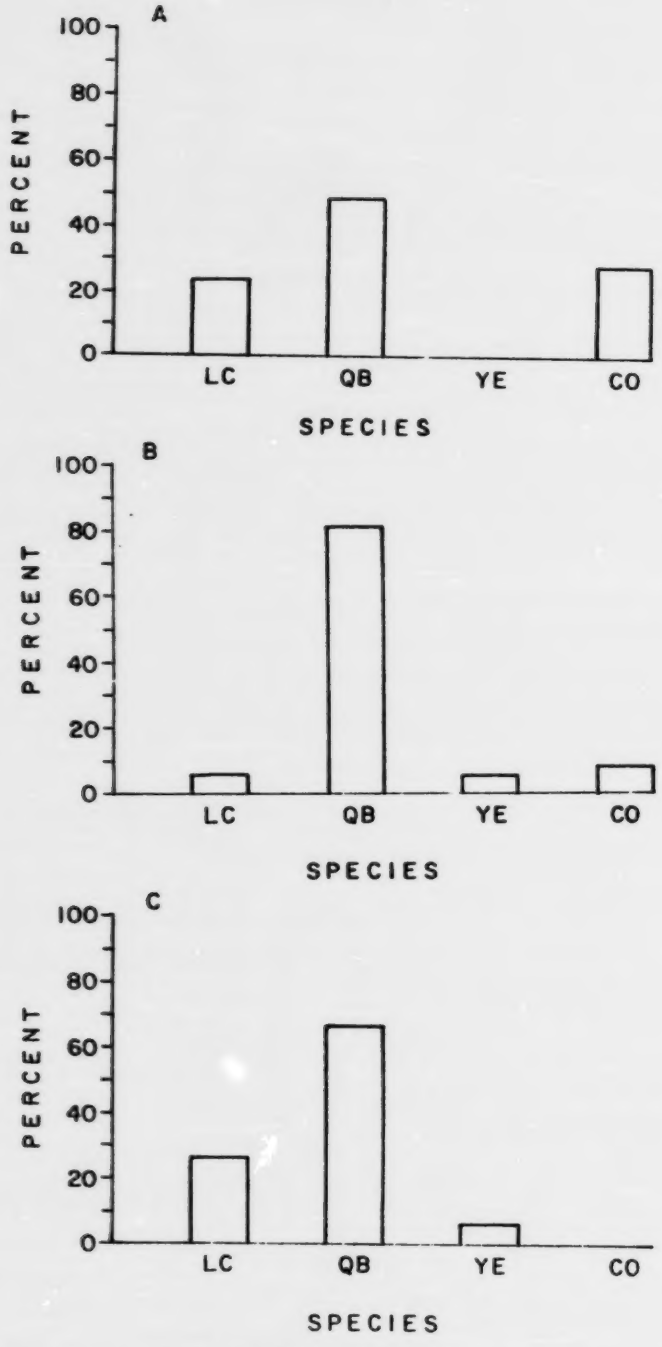


Fig. 5. The percentage of lingcod (LC), quillback rockfish (QB), yelloweye rockfish (YE) and copper rockfish (CO) in the catch during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985, using the research fishing method in (A) the 5-27 m depth interval, (B) the 28-45 m depth interval and (C) the 46-55 m depth interval.

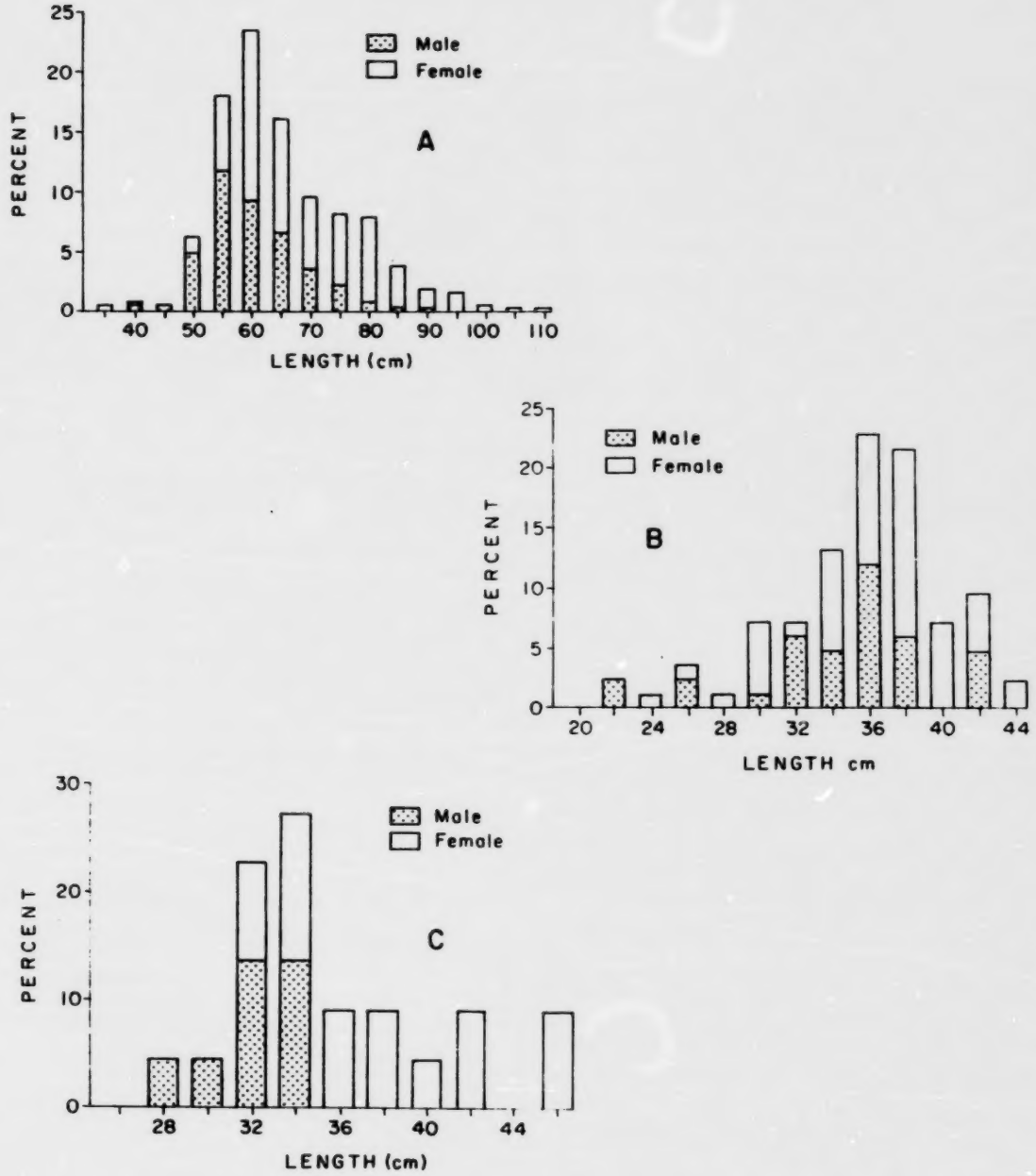


Fig. 6. Length-frequency histograms for (A) lingcod, (B) copper rockfish and (C) quillback rockfish during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985.

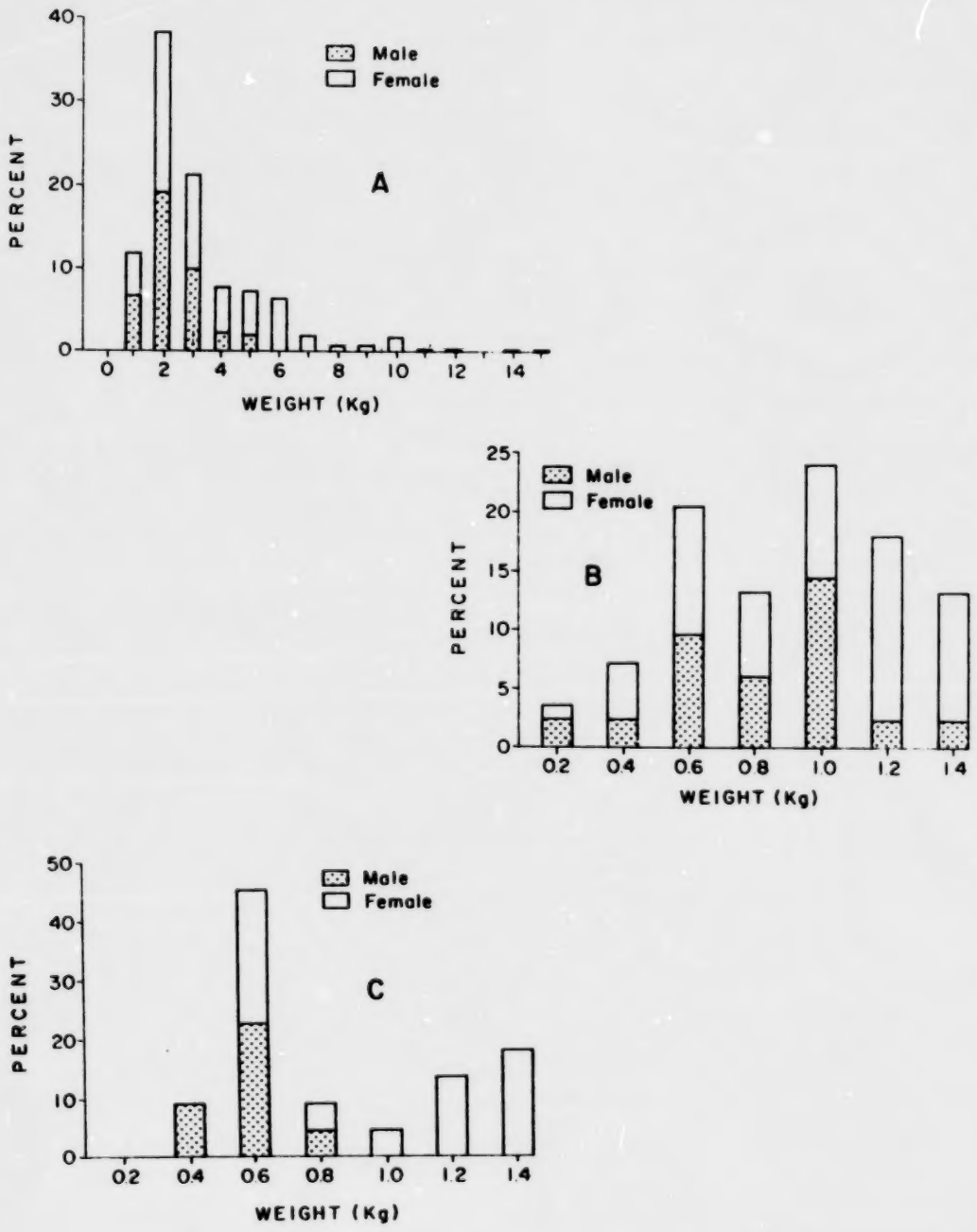


Fig. 7. Weight-frequency histograms for (A) lingcod, (B) copper rockfish and (C) quillback rockfish during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985.

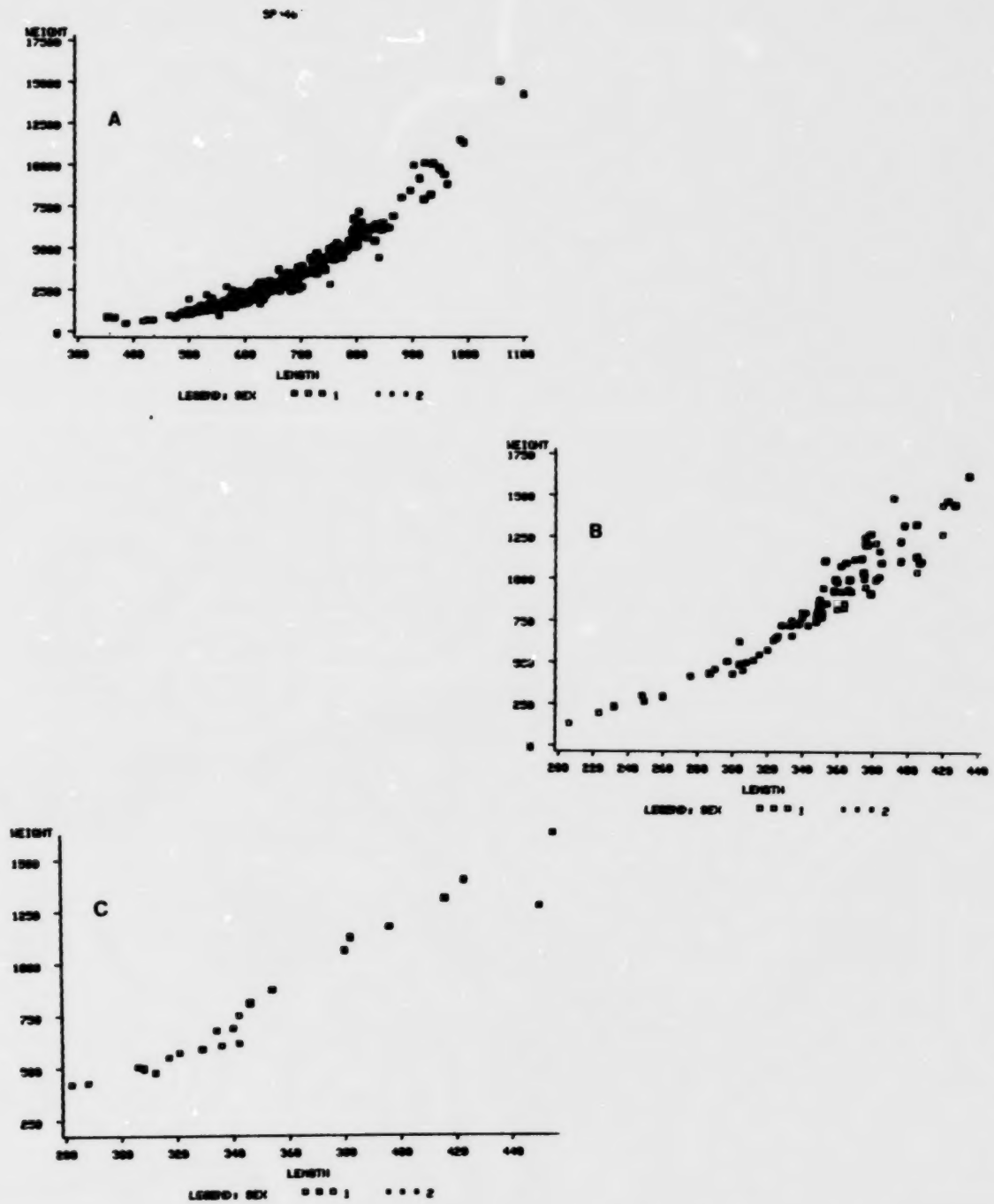


Fig. 8. The relationship between weight (g) and fork length (mm) for (A) lingcod, (B) quillback rockfish and (C) copper rockfish during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985.

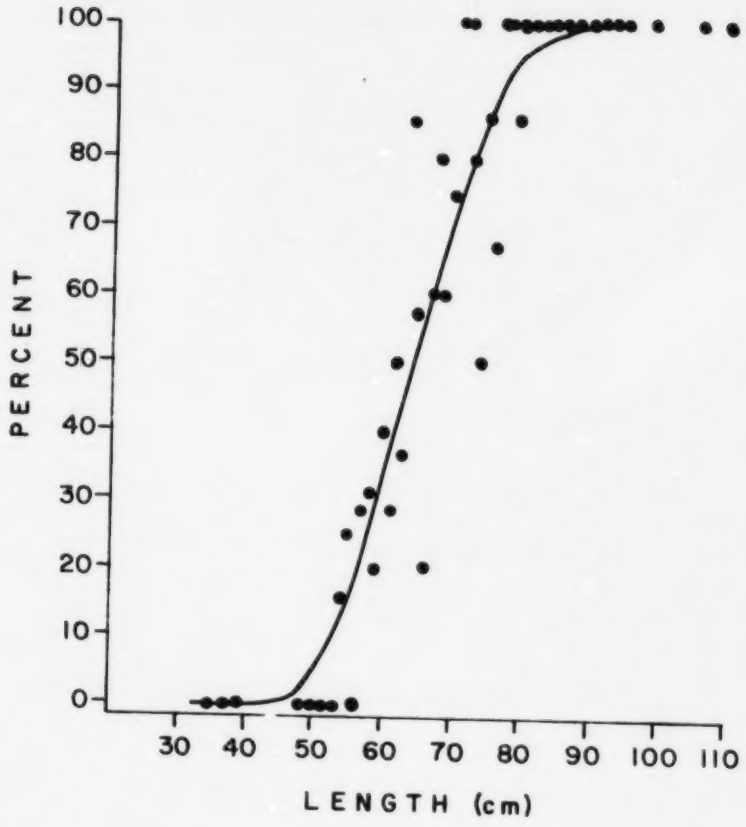


Fig. 9. Maturity ogive for female lingcod during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985.

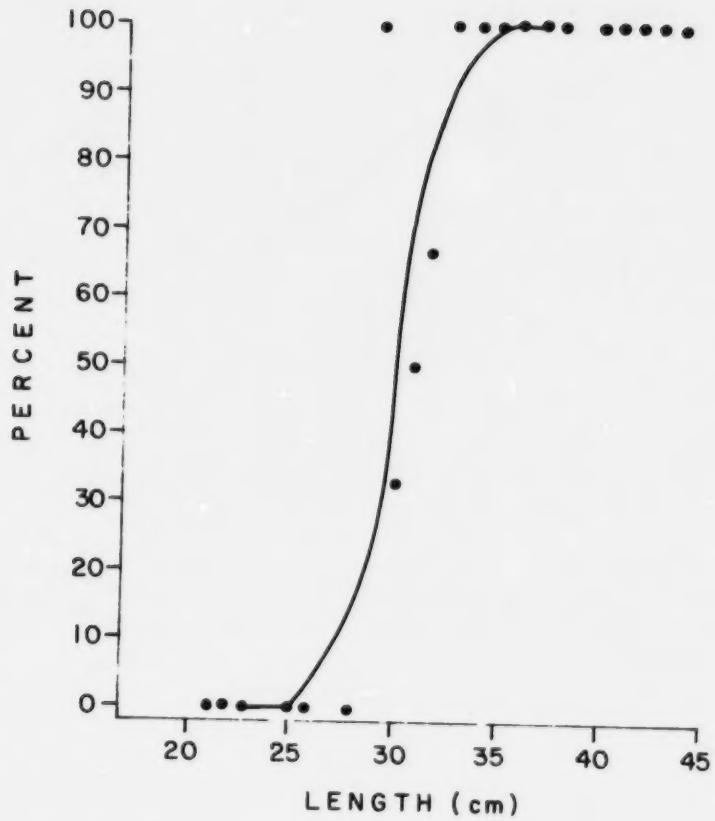
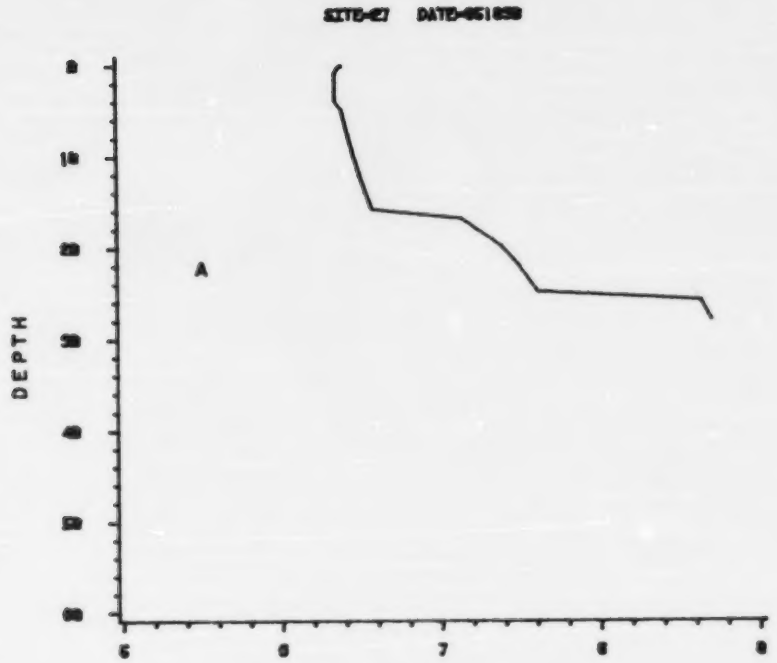
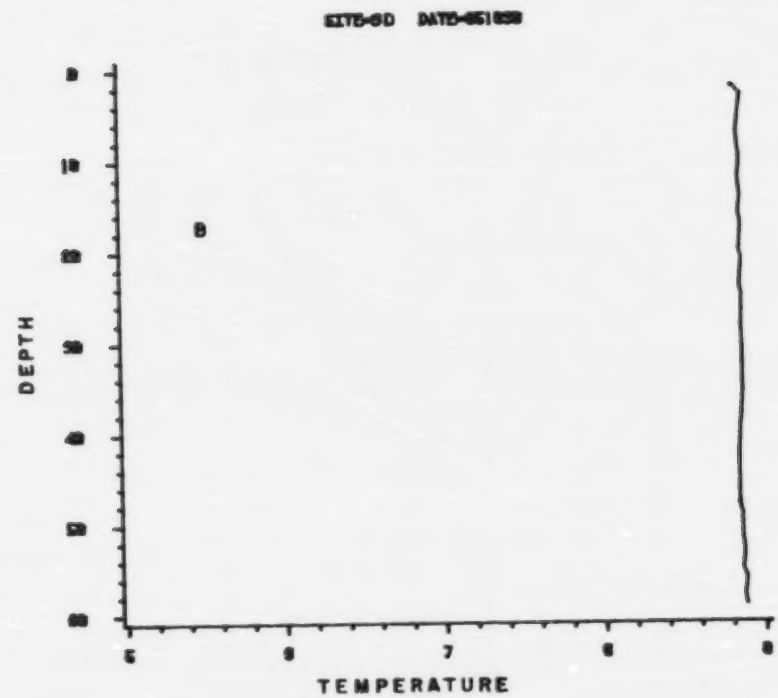
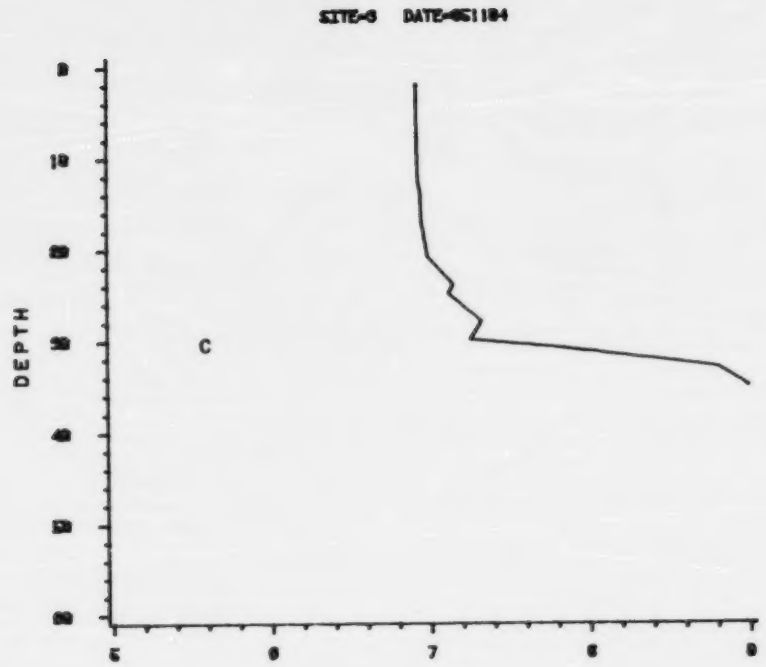


Fig. 10. Maturity ogive for combined sexes of quillback rockfish during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985.

Fig. 11. Temperature (°C) profiles by site and date during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985.


DEPTH
A
6
7
8


DEPTH
B
6
7
8
TEMPERATURE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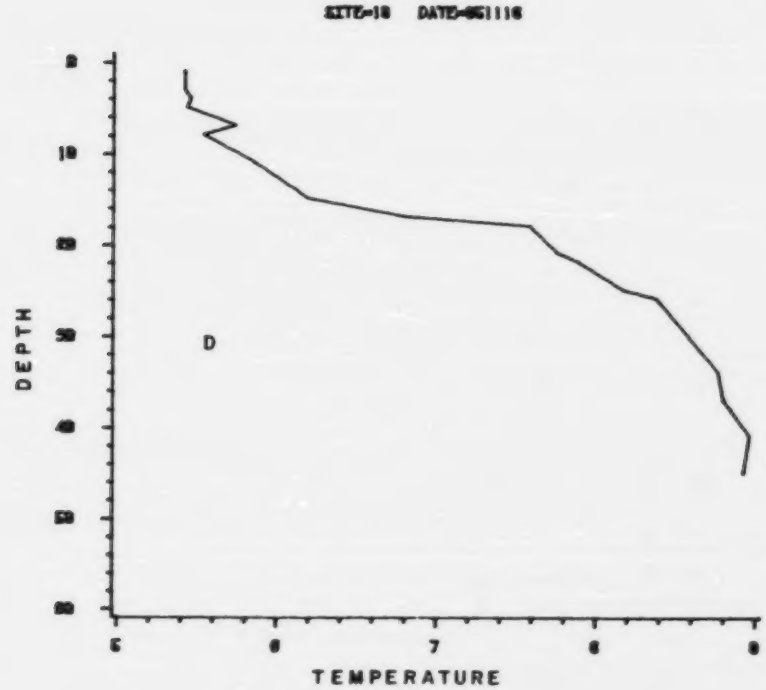
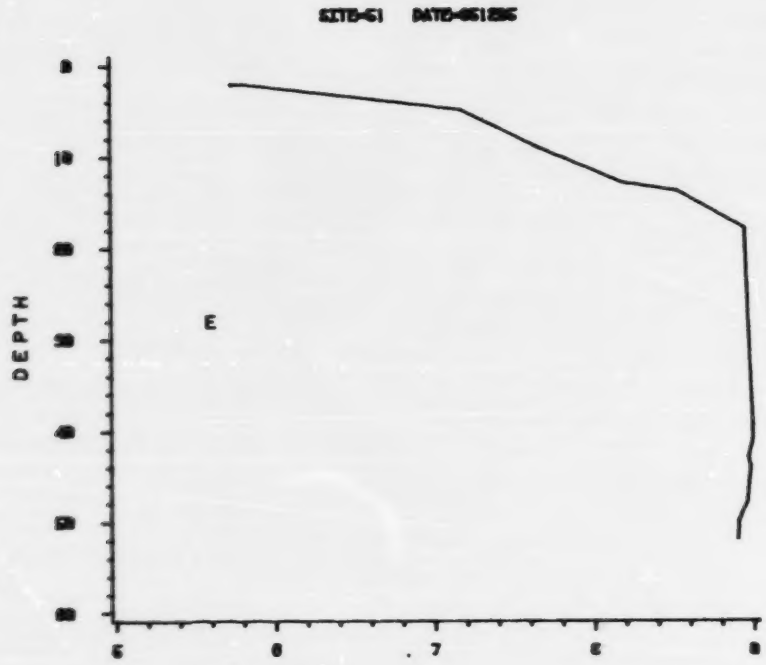
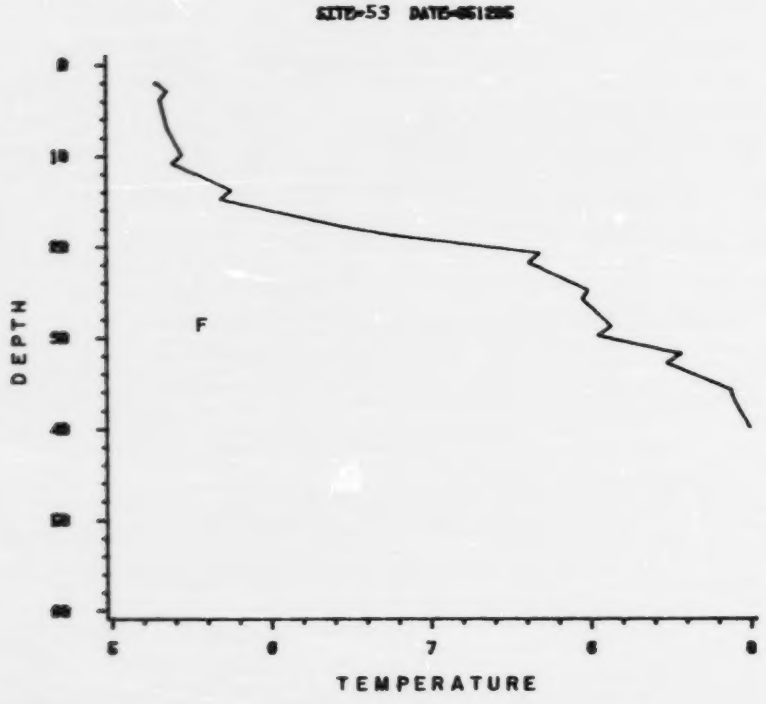
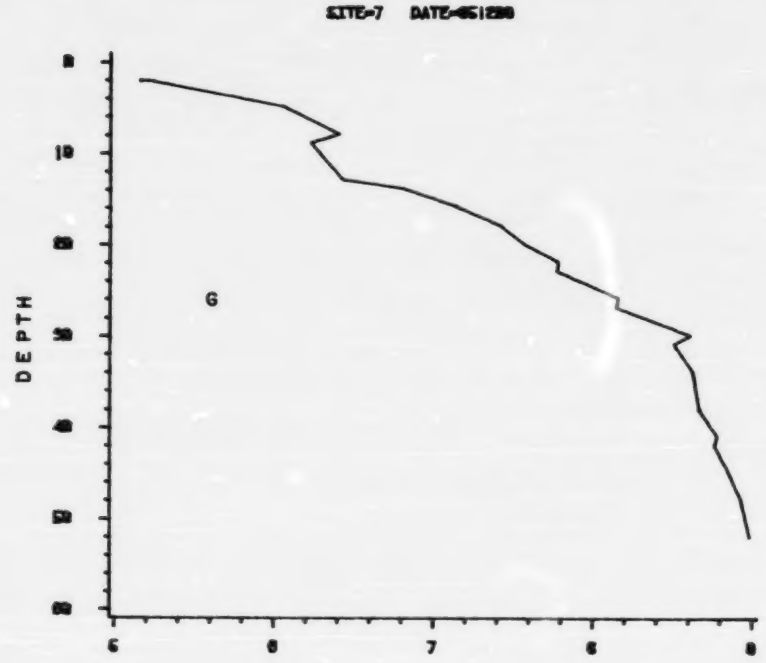
DEPTH
C


SITE-D DATE-051116
DEPTH
D
TEMPERATURE


DEPTH
E
.7


DEPTH
F
7
TEMPERATURE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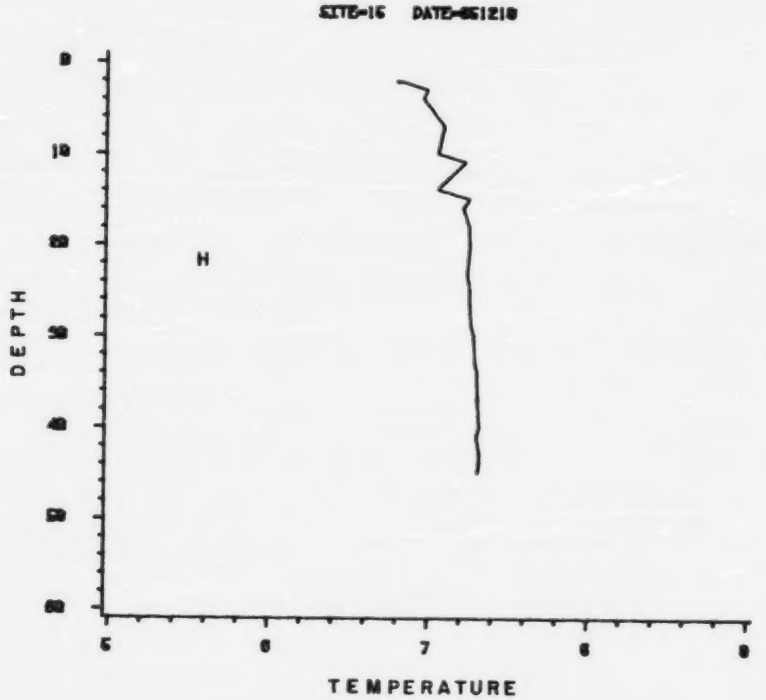
DEPTH
G
5
6
7
8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DEPTH
H
5
6
7
8
TEMPERATURE

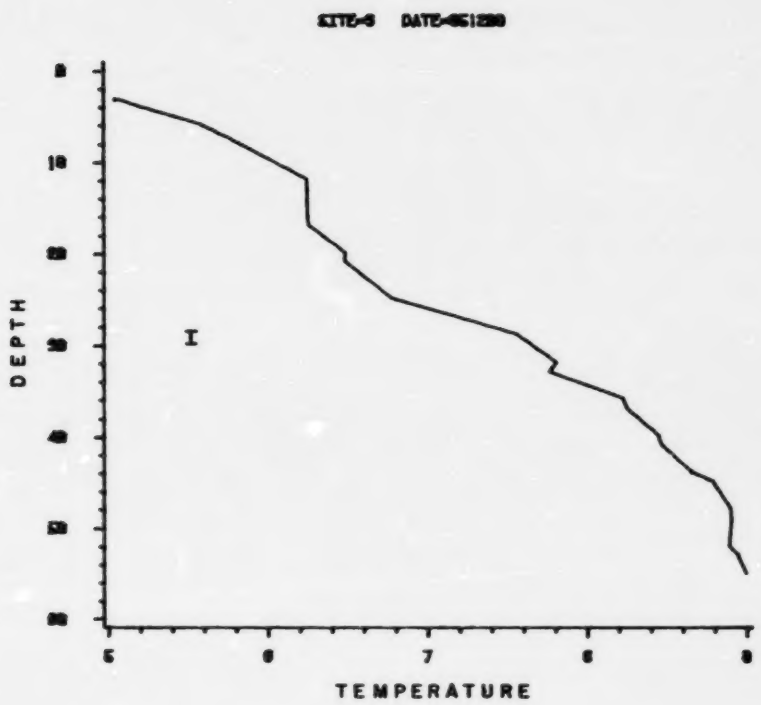
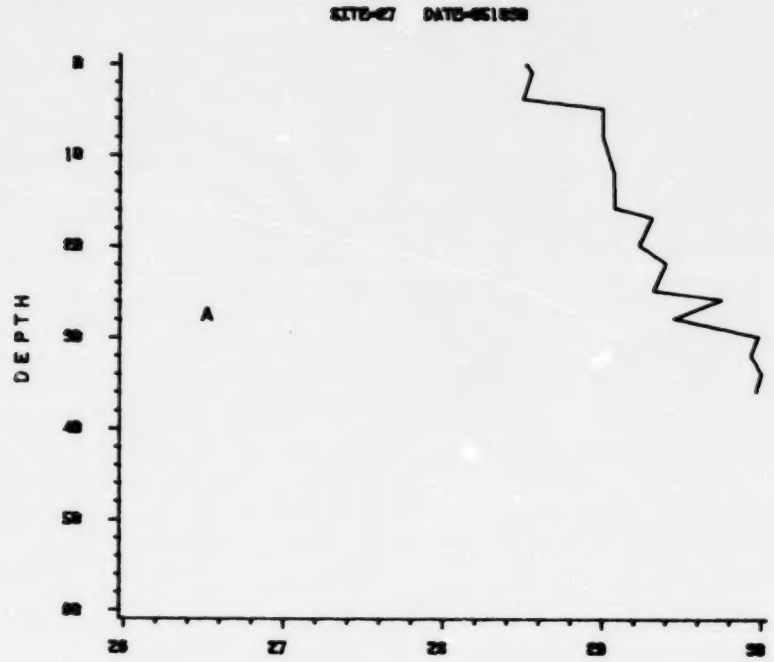
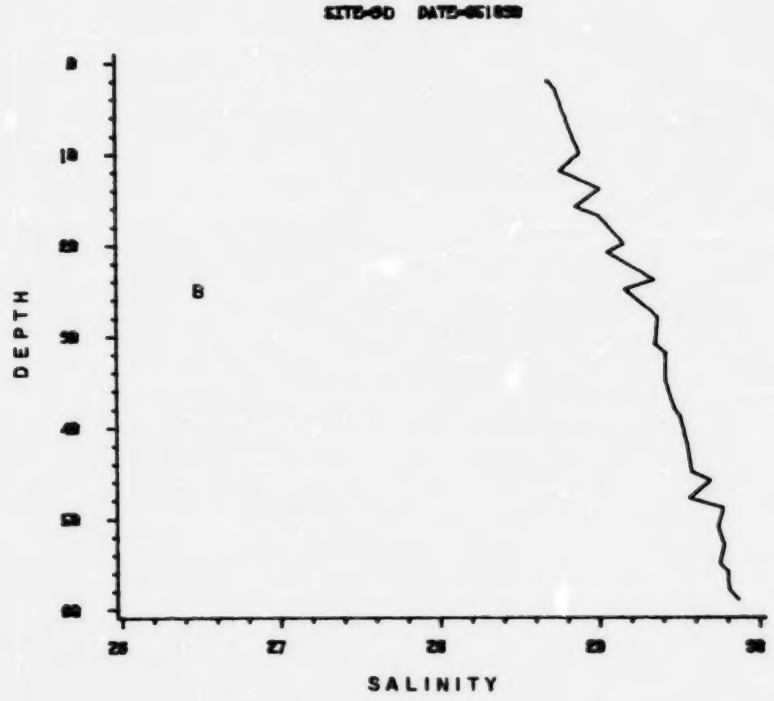
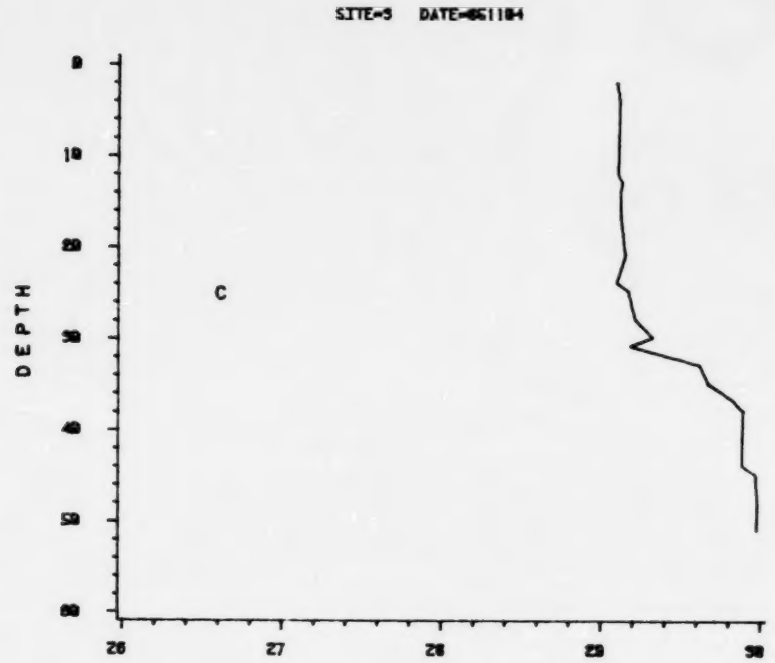

DEPTH
TEMPERATURE
I

Fig. 12. Salinity ($^{o}/_{oo}$) profiles by site and date during a research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 11, 1985.


DEPTH
A


DEPTH
B
SALINITY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DEPTH
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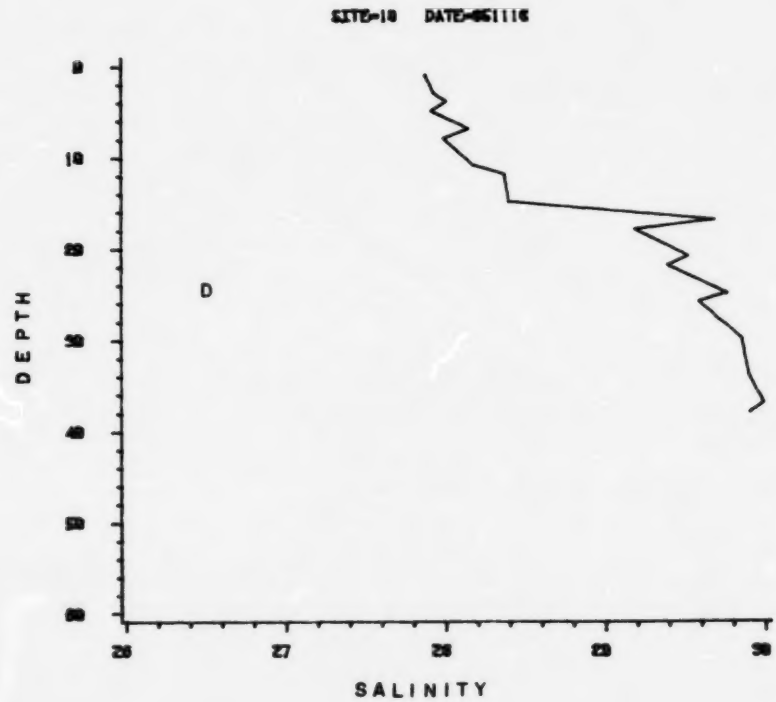
30
40
50
60
26
27
28
29
30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40
50
60
26
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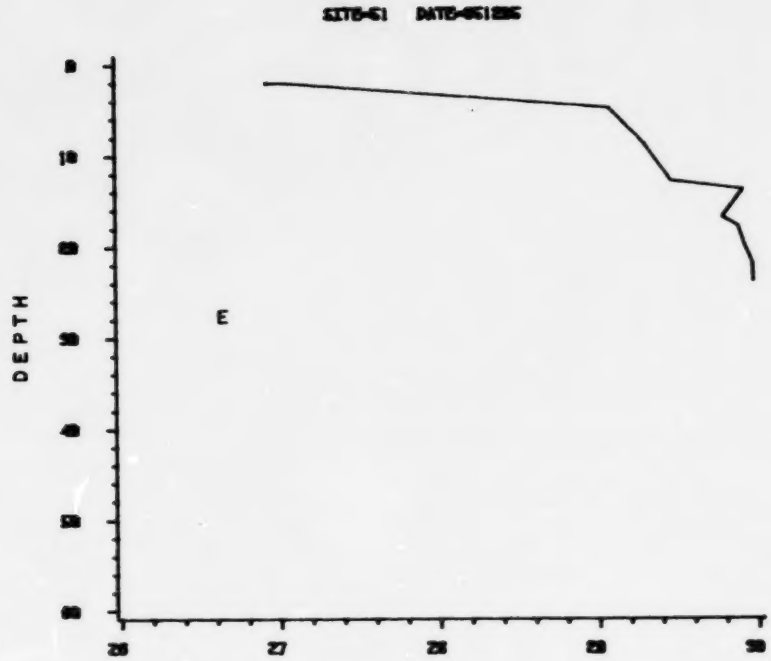
28
29
30
SALINITY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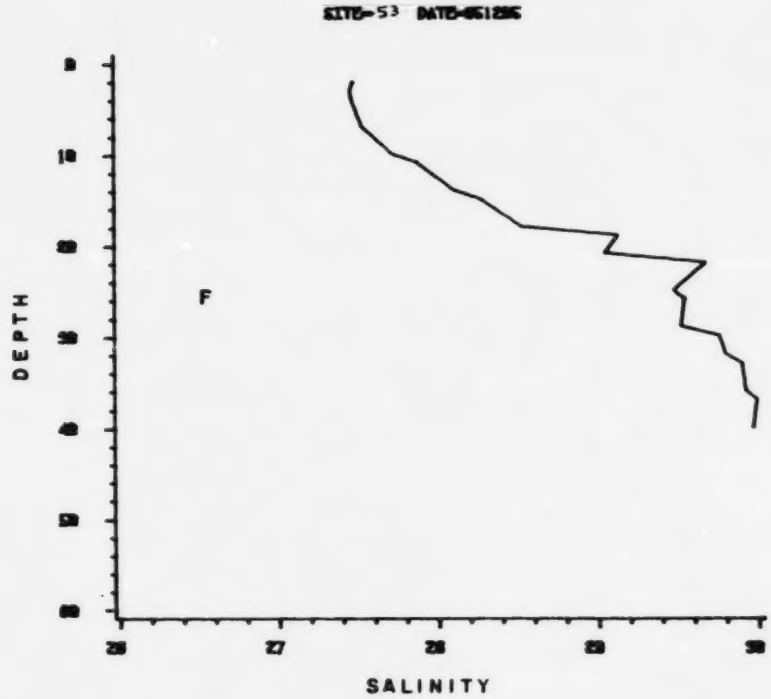
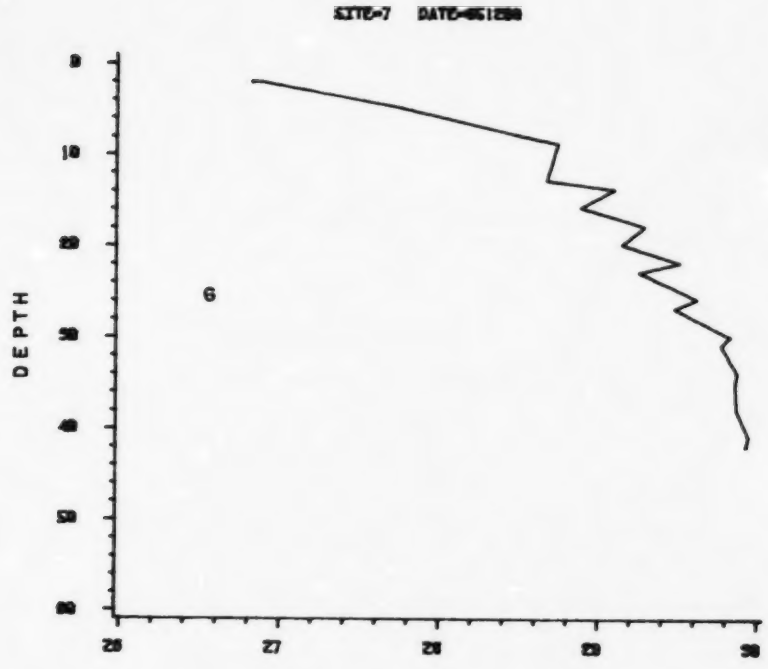
E


DEPTH
F
SALINITY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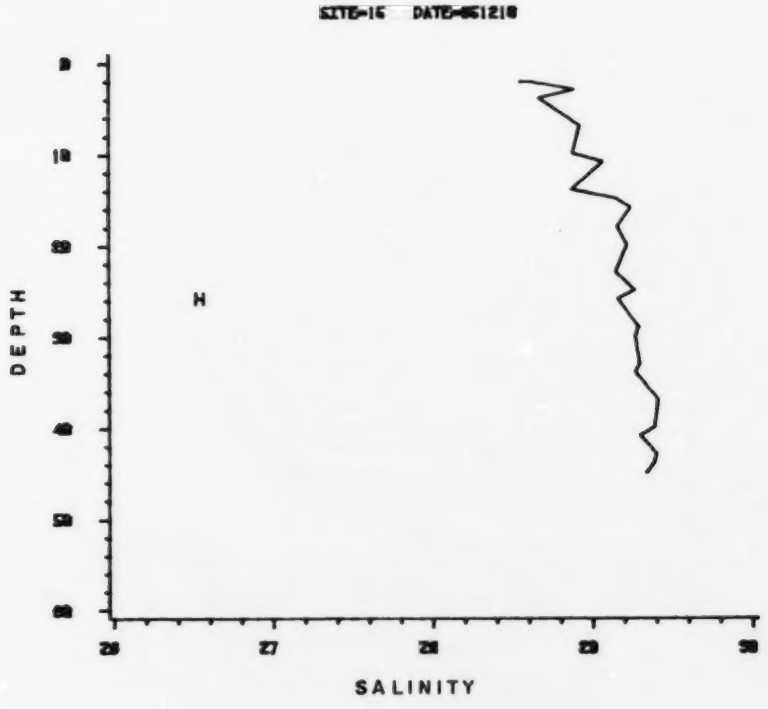
DEPTH
G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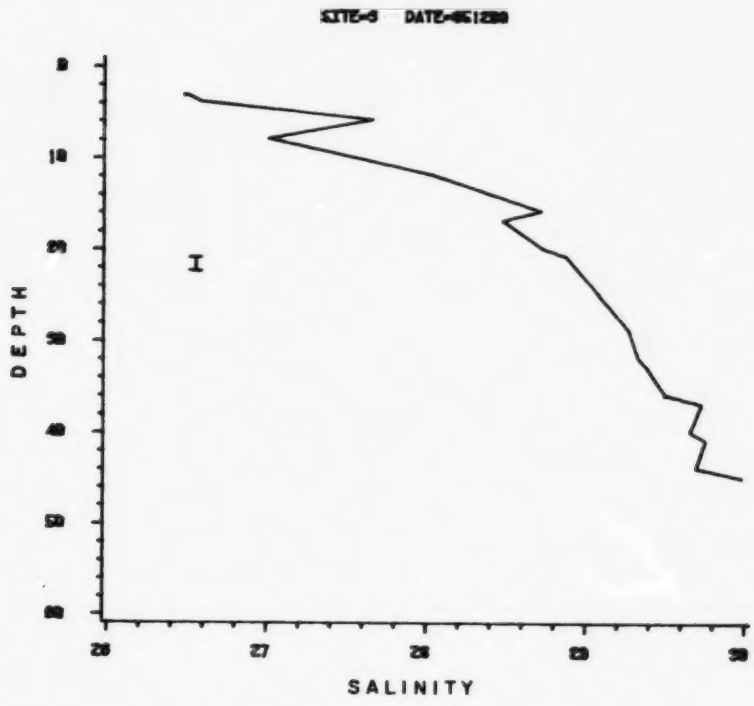
DEPTH
H
SALINITY


DEPTH
SALINITY
27

APPENDIX TABLE 1. Catch and effort data collected during a lingcod hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28 - December 12 1985. Codes for depth, cloud cover (SUN), sea condition (SEA), tide and current (CURR) are presented in Appendix Table 2. REC=record, LC=lingcod, QB=quillback rockfish, YE=yelloweye rockfish, CO=copper rockfish, GS=greenstriped rockfish, BR=black rockfish, KG=kelp greenling, CA=cabezon, DF=spiny dogfish, RS=rock sole and PC=Pacific cod.

REC	DATE	SITE	TIME	DEPTH	SUN	SEA	TIDE	CURR	EFFORT	LC	QB	YE	CO	GS	BR	KG	CA	DF	RS	PC
A. Commercial fishing method																				
1	851028	7	956	1	1	1	-1	2	0.50	12	-	-	-	-	-	-	-	-	-	-
2	851028	7	1026	1	1	1	-1	2	0.40	5	-	-	-	-	-	-	-	-	-	-
3	851028	3	1103	1	1	1	00	3	1.03	27	-	-	-	-	1	-	-	-	-	-
4	851028	3	1215	3	1	1	+1	2	0.87	12	-	1	-	-	-	-	-	-	-	-
5	851028	3	1334	1	1	2	+2	3	0.77	12	-	-	-	-	-	-	-	1	-	-
6	851028	7	1447	1	3	2	+4	2	0.27	17	-	-	-	-	-	-	-	-	-	-
7	851030	27	937	1	1	2	-4	2	0.67	5	-	-	2	-	-	-	-	-	-	-
8	851030	27	1015	1	1	1	-2	2	0.47	5	-	-	-	-	-	-	-	-	-	-
9	851030	30	1047	2	1	1	-2	2	0.63	7	-	1	-	-	-	-	-	-	-	-
10	851030	30	1157	1	1	1	00	2	0.63	9	-	-	-	-	-	-	-	-	-	-
11	851030	30	1225	1	3	2	00	1	0.50	5	-	-	-	-	-	-	-	-	-	-
12	851030	27	1300	1	3	2	+1	3	0.47	6	-	-	1	-	-	-	-	-	-	-
13	851030	27	1323	1	1	3	+1	3	0.33	6	-	-	-	-	-	-	-	-	-	-
14	851030	27	1402	1	1	2	+2	2	0.20	13	-	-	-	-	-	-	1	-	-	-
15	851030	27	1428	1	1	2	+2	2	0.20	4	-	-	-	-	-	-	-	-	-	-
16	851101	27	1008	1	2	1	-4	3	0.47	10	1	-	-	-	-	-	-	2	-	-
17	851101	27	1044	2	2	2	-4	3	0.50	2	-	-	-	-	-	-	-	-	-	-
18	851101	27	1114	2	2	3	-3	3	0.43	20	1	-	-	-	-	-	-	-	-	-
19	851101	27	1229	1	2	4	-2	4	0.30	-	-	-	-	-	-	-	-	-	-	-
20	851101	15	1300	1	2	2	-2	3	0.50	10	-	-	-	-	-	-	-	-	-	-
21	851101	15	1332	1	2	1	-1	3	0.53	11	-	-	-	-	-	-	-	-	-	-
22	851104	51	940	1	2	1	+1	2	1.00	3	-	-	-	-	-	-	-	-	-	-

APPENDIX TABLE 1 (cont'd)

REC	DATE	SITE	TIME	DEPTH	SUN	SEA	TIDE	CURR	EFFORT	LC	QB	YE	CO	GS	BR	KG	CA	DF	RS	PC
23	851104	51	1040	1	2	1	+5	2	0.77	2	-	-	-	-	-	-	-	-	-	-
24	851104	51	1114	2	3	2	+6	2	0.50	-	2	-	1	-	-	-	-	2	-	-
25	851104	51	1145	2	1	1	+6	2	0.67	2	-	-	-	-	-	-	-	-	-	-
26	851104	51	1228	3	3	1	-5	2	0.47	-	1	-	-	-	-	-	-	2	-	-
27	851104	53	1420	2	3	2	-3	2	0.73	1	2	-	-	-	-	-	-	-	-	-
28	851104	53	1455	1	3	2	-2	2	0.50	4	-	-	-	-	-	-	-	-	-	-
29	851104	53	1527	3	2	2	-2	2	0.60	2	-	-	-	-	-	-	-	-	-	-
30	851106	12	900	2	2	1	+4	2	0.47	3	-	-	-	-	-	-	-	4	-	-
31	851106	12	942	1	2	1	+4	2	0.50	19	-	-	-	-	-	-	-	-	-	-
32	851106	12	1025	3	2	1	+5	3	0.20	4	-	5	-	-	-	-	-	-	-	-
33	851106	12	1030	2	2	1	+5	3	0.43	5	1	1	-	-	-	-	-	2	-	-
34	851106	12	1046	3	2	1	+5	2	0.13	-	-	-	-	-	-	-	-	2	-	-
35	851106	19	1233	1	2	1	+6	2	0.57	4	-	-	-	-	-	-	-	-	-	-
36	851106	19	1315	2	2	1	+6	1	0.47	-	-	-	-	-	-	-	-	-	-	-
37	851106	19	1335	2	2	1	-5	2	0.50	5	-	-	-	-	-	-	-	-	-	-
38	851106	19	1410	3	2	1	-5	2	0.37	-	-	-	-	-	-	-	-	-	-	-
39	851118	19	1052	1	1	1	+6	2	0.93	2	-	-	-	-	-	-	-	-	-	-
40	851118	19	1150	2	1	1	+6	2	1.13	-	-	-	-	-	-	-	-	-	-	-
41	851118	19	1230	3	1	1	-5	2	0.77	-	-	-	1	-	-	-	-	-	-	-
42	851118	27	1345	1	1	1	-4	2	0.93	8	3	-	2	-	-	-	-	-	-	-
43	851118	27	1500	2	1	1	-3	2	0.43	4	5	-	-	-	-	-	-	-	-	-
44	851205	53	1100	1	2	2	+5	3	0.83	1	-	-	-	-	-	-	-	-	-	-
45	851205	53	1140	3	2	2	+6	3	0.60	1	-	-	-	-	-	-	-	-	-	-
46	851205	53	1207	2	2	2	+6	3	0.63	3	1	-	-	-	-	-	-	-	-	-
47	851205	51	1400	1	2	2	-4	3	0.80	4	-	-	-	-	-	-	-	-	-	-
48	851205	51	1445	2	2	3	-3	3	1.37	1	2	-	-	-	-	-	-	-	-	-
49	851209	3	1120	1	2	2	+3	2	0.93	6	-	-	-	-	-	-	-	-	-	-
50	851209	3	1210	2	2	2	+4	2	0.90	3	-	-	-	-	-	-	-	-	-	-
51	851209	3	1300	3	2	2	+5	2	0.63	1	-	3	-	-	-	-	-	-	-	-

APPENDIX TABLE 1 (cont'd)

REC	DATE	SITE	TIME	DEPTH	SUN	SEA	TIDE	CURR	EFFORT	LC	QB	YE	CO	GS	BR	KG	CA	DF	RS	PC
52	851209	7	1410	1	2	1	+6	2	0.67	12	-	-	-	-	-	-	-	-	-	-
53	851209	7	1455	2	2	1	-5	2	0.33	2	-	-	-	-	-	-	-	-	-	-
54	851209	7	1515	3	2	1	-5	2	0.50	2	-	1	-	-	-	-	-	-	-	-
55	851210	13	1130	2	1	2	+2	2	0.50	12	-	-	-	-	-	-	-	-	-	-
56	851210	13	1210	2	1	2	+3	2	0.33	-	-	-	-	-	-	-	-	-	-	-
57	851210	13	1230	3	1	2	+3	2	0.80	1	-	1	-	-	-	-	-	-	-	-
58	851210	13	1315	1	1	2	+5	2	0.40	11	-	-	-	-	-	-	-	-	-	-
59	851210	27	1400	3	1	2	+6	2	1.07	1	-	-	-	-	-	-	-	-	-	-
60	851211	30	1006	2	3	1	00	2	0.67	6	-	-	-	-	-	1	-	-	-	-
61	851211	30	1055	1	1	1	00	2	0.43	15	-	-	-	-	-	-	-	-	-	-
62	851211	27	1130	1	1	1	+1	2	0.50	7	-	-	-	-	-	-	-	-	-	-
63	851211	27	1205	3	1	1	+2	2	0.40	1	1	-	-	-	-	-	-	-	-	-
64	851211	27	1230	3	1	1	+2	3	0.47	1	2	-	-	-	-	-	-	-	-	-
B. Research fishing method																				
21	851101	15	1332	1	2	1	-1	3	0.40	-	7	-	-	-	-	-	-	-	-	-
22	851104	51	940	1	2	1	+1	2	1.00	1	-	-	-	-	-	-	-	-	-	-
23	851104	51	1040	1	2	1	+5	2	0.63	-	-	-	-	-	-	-	-	-	-	-
24	851104	51	1114	2	3	2	+6	2	0.43	-	1	-	-	-	-	-	-	-	-	-
25	851104	51	1145	2	1	1	+6	2	0.53	-	1	-	-	-	-	-	-	-	-	-
26	851104	51	1228	3	3	1	-5	2	0.47	-	-	-	-	-	-	-	-	-	-	-
27	851104	53	1420	2	3	2	-3	2	0.50	-	3	-	-	-	-	-	-	-	-	-
28	851104	53	1455	1	3	2	-2	2	0.43	-	-	-	3	-	-	-	-	-	-	-
29	851104	53	1527	3	2	2	-2	2	0.50	-	1	-	-	-	-	-	-	-	-	-
30	851106	12	900	2	2	1	+4	2	0.50	-	1	-	-	-	-	-	-	2	-	-
31	851106	12	942	1	2	1	+4	2	0.53	2	5	-	-	-	-	-	-	-	-	-
32	851106	12	1025	3	2	1	+5	3	0.53	3	4	-	-	-	-	-	-	-	-	-
34	851106	12	1046	3	2	1	+5	2	0.13	-	2	-	-	-	-	-	-	-	-	-

APPENDIX TABLE 1 (cont'd)

REC	DATE	SITE	TIME	DEPTH	SUN	SEA	TIDE	CURR	EFFORT	LC	QB	YE	CO	GS	BR	KG	CA	DF	RS	PC
35	851106	19	1233	1	2	1	+6	2	0.53	-	5	-	1	-	-	-	-	-	-	-
36	851106	19	1315	2	2	1	+6	1	0.47	-	-	-	-	-	-	-	-	-	-	-
37	851106	19	1335	2	2	1	-5	2	0.57	-	-	-	-	-	-	-	-	-	-	-
38	851106	19	1410	3	2	1	-5	2	0.50	-	-	-	-	-	-	-	-	-	-	1
39	851118	19	1052	1	1	1	+6	2	0.90	1	1	-	1	-	-	-	-	-	-	-
41	851118	19	1230	3	1	1	-5	2	0.77	-	-	-	-	1	-	-	-	-	1	-
42	851118	27	1345	1	1	1	-4	2	0.87	-	9	-	4	-	-	-	-	-	1	-
43	851118	27	1500	2	1	1	-3	2	0.43	-	10	-	2	-	-	-	-	-	-	-
44	851205	53	1100	1	2	2	+5	3	0.80	-	-	-	1	-	-	-	-	-	-	-
45	851205	53	1140	3	2	2	+6	3	0.50	-	1	-	-	-	-	-	-	-	-	-
46	851205	53	1207	2	2	2	+6	3	0.50	2	3	-	1	-	-	-	-	-	-	-
47	851205	51	1400	1	2	2	-4	3	0.70	-	-	-	-	-	-	-	-	-	1	-
48	851205	51	1445	2	2	3	-3	3	0.90	-	5	-	-	-	-	-	-	-	-	-
49	851209	3	1120	1	2	2	+3	2	0.80	1	1	-	3	-	-	-	-	-	-	-
50	851209	3	1210	2	2	2	+4	2	1.00	-	-	-	-	-	-	-	-	-	-	-
51	851209	3	1300	3	2	2	+5	2	0.57	-	1	-	-	-	-	-	-	-	-	-
52	851209	7	1410	1	2	1	+6	2	0.57	2	2	-	-	-	-	-	-	-	-	-
53	851209	7	1455	2	2	1	-5	2	0.30	-	1	-	-	-	-	-	-	-	-	-
54	851209	7	1515	3	2	1	-5	2	0.50	1	1	-	-	-	-	-	-	-	-	-
55	851210	13	1130	2	1	2	+2	2	0.60	-	5	1	-	-	-	-	-	-	-	-
56	851210	13	1210	2	1	2	+3	2	0.30	-	-	-	-	-	-	-	-	-	-	-
57	851210	13	1230	3	1	2	+3	2	0.33	-	-	1	-	-	-	-	-	-	-	-
58	851210	13	1315	1	1	2	+5	2	0.25	1	-	-	4	-	-	-	-	-	-	-
59	851210	27	1400	3	1	2	+6	2	0.30	-	-	-	-	-	-	-	-	-	-	-
60	851211	30	1006	2	3	1	00	2	0.67	-	-	1	-	-	-	-	-	-	-	-
61	851211	30	1055	1	1	1	00	2	0.50	2	-	-	-	-	-	-	-	-	-	-
62	851211	27	1130	1	1	1	+1	2	0.47	3	1	-	1	-	-	-	-	-	-	-
63	851211	27	1205	3	1	1	+2	2	0.40	-	-	-	-	-	-	-	-	-	-	-
64	851211	27	1230	3	1	1	+2	3	0.53	2	-	-	-	-	-	-	-	-	-	-

Appendix table 2. Codes used in Appendix Table 1 to describe depth, sun, sea, tide and current conditions during lingcod research hook and line surveys in the Gulf Island area of the Strait of Georgia, October 28 - December 12 1985.

depth	1	5-27 m (3-15 fa)
	2	28-45 m (16-25 fa)
	3	46-55 m (26-30 fa)
sun	1	bright
	2	dull or overcast
	3	variable
	4	rain
sea state	1	calm
	2	rippled
	3	0.5 m chop
	4	1.0 m chop
	5	1.5 m chop
	6	swell
tide	code as hours from low slack on a scale of -5 (one hour after high slack) to 0 (low slack) to +6 (high slack)	
current	1	nil
	2	weak
	3	moderate
	4	strong

Appendix table 3. Date, site number, mean depth (m), sex, fork length (mm), weight (g), maturity code and fish number by species for the landed catch during a lingcod hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28 - December 12 1985.

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
A. COPPER ROCKFISH							
851209	3	10	-	287	413	3	-
851030	27	12	1	342	750	3	6861
851104	53	17	1	334	680	3	6865
851104	53	17	1	282	425	3	6866
851118	15	34	1	336	610	7	6883
851205	53	32	1	288	430	1	6872
851210	13	17	1	317	555	3	6877
851210	13	17	1	321	573	3	6880
851211	27	11	1	306	506	3	6881
851030	27	12	2	312	480	2	6862
851030	27	7	2	396	1175	2	6863
851106	19	15	2	380	1060	2	6867
851118	19	55	2	423	1400	2	6868
851118	27	17	2	416	1310	2	6869
851118	27	17	2	455	1625	2	6870
851118	19	20	2	308	500	2	6871
851118	27	34	2	346	810	2	6882
851205	53	27	2	340	692	2	6873
851209	3	10	2	382	1123	2	6874
851209	3	10	2	354	876	3	6875
851210	13	17	2	342	620	2	6878
851210	13	17	2	329	591	2	6879
B. GREENSTRIPED ROCKFISH							
851118	19	55	1	252	170	1	-
C. QUILLBACK ROCKFISH							
851101	15	27	1	420	1450	2	6961
851101	15	9	1	349	850	2	6969
851104	53	32	1	308	500	1	6970
851104	53	32	1	360	980	3	6975
851104	53	32	1	368	925	3	6976
851104	51	37	1	360	825	3	6979
851104	51	62	1	420	1275	3	6980
851106	12	18	1	315	550	3	6982
851106	12	18	1	312	515	3	6984
851106	12	18	1	351	850	3	6985

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
851106	19	15	1	223	200	1	6990
851106	19	15	1	248	300	1	6992
851106	19	15	1	290	460	3	6993
851106	12	46	1	384	1015	4	6994
851106	12	46	1	362	925	3	6995
851106	12	46	1	340	775	3	6996
851106	12	40	1	375	1000	3	6998
851118	15	34	1	306	455	7	6884
851118	15	17	1	340	800	3	7000
851118	19	20	1	249	270	1	7007
851118	27	34	1	352	950	3	7037
851118	27	34	1	382	1220	4	7040
851205	53	32	1	364	861	3	7008
851205	53	55	1	408	1105	3	7011
851205	51	37	1	405	1044	3	7012
851205	51	37	1	364	831	2	7013
851205	51	37	1	206	134	1	7019
851209	3	10	1	354	855	3	7020
851209	3	50	1	376	956	4	7022
851210	13	30	1	348	789	3	7026
851210	13	30	1	323	638	2	7027
851210	13	30	1	326	665	3	7029
851211	27	11	1	343	729	3	7031
851211	27	5	2	352	886	2	7032
851211	27	5	2	366	858	2	7033
851101	15	44	2	423	1475	2	6962
851101	15	9	2	325	650	7	6963
851101	15	9	2	328	725	7	6964
851101	15	9	2	260	300	1	6965
851101	15	9	2	365	1100	7	6966
851101	15	9	2	398	1325	7	6967
851101	15	9	2	352	375	7	6968
851104	53	32	2	320	580	1	6971
851104	51	37	2	385	1100	7	6972
851104	51	37	2	435	1625	7	6972
851104	53	55	2	333	725	7	6973
851104	53	32	2	376	1250	7	6977
851104	51	37	2	407	1100	7	6978
851106	12	18	2	338	735	7	6983
851106	12	18	2	349	810	7	6986
851106	12	55	2	376	1210	2	6987
851106	12	55	2	427	1450	7	6988
851106	12	39	2	382	1000	2	6989
851106	19	15	2	297	510	1	6991
851106	19	15	2	232	235	1	6994
851106	12	46	2	379	915	7	6999
851118	27	17	2	348	750	2	6999

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
851118	27	17	2	359	1000	2	7001
851118	27	34	2	362	1080	2	7002
851118	27	34	2	392	1490	2	7003
851118	27	34	2	374	1125	2	7004
851118	27	34	2	375	1040	2	7005
851118	27	34	2	398	1325	2	7006
851118	27	34	2	334	750	3	7038
851118	27	34	2	377	1210	3	7039
851118	27	34	2	370	1120	3	7041
851118	27	34	2	353	1110	3	7042
851118	27	34	2	350	875	2	7043
851118	27	34	2	304	630	3	7044
851205	53	32	2	351	803	2	7009
851205	53	32	2	405	1335	3	7010
851205	53	29	2	396	1111	2	7014
851205	51	37	2	405	1138	2	7015
851205	51	37	2	396	1230	2	7016
851205	51	37	2	334	662	2	7017
851205	51	37	2	300	435	2	7018
851209	7	33	2	358	931	2	7021
851209	7	18	2	276	421	1	7023
851209	7	18	2	351	773	2	7024
851209	7	55	2	304	492	1	7025
851210	13	30	2	342	803	2	7028
851210	13	30	2	287	437	2	7030
851211	27	50	2	384	1171	2	7034
851211	27	50	2	379	1276	2	7035
851211	27	49	2	366	939	2	7036
C. BLACK ROCKFISH							
851028	3	17	1	546	-	2	-
D. YELLOWEYE ROCKFISH							
851028	3	46	1	622	-	3	6661
851030	30	41	1	568	3300	3	6662
851106	12	46	1	446	1350	3	6663
851106	12	46	1	473	1675	3	6667
851210	13	30	1	402	1186	1	6674
851106	12	46	2	472	1825	2	6664
851106	12	46	2	515	2325	7	6665
851106	12	46	2	588	3300	2	6666
851209	7	55	2	393	1234	2	6668
851209	3	50	2	629	4252	3	6669
851209	3	50	2	604	4652	2	6670
851209	3	50	2	327	645	1	6671
851210	13	48	2	399	1119	2	6672
851210	13	48	2	477	2087	3	6673

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
E. KELP GREENLING							
851211	30	34	2	802	6100	5	-
F. LINGCOD							
851028	7	12	1	782	5025	5	40002
851028	7	12	1	648	3000	4	40004
851028	7	12	1	565	1750	4	40005
851028	7	12	1	740	4500	5	40009
851028	7	12	1	750	5000	5	40012
851028	7	12	1	500	2000	4	40014
851028	3	15	1	577	2500	3	40018
851028	3	15	1	567	2750	4	40022
851028	3	15	1	532	2250	4	40023
851028	3	15	1	643	3000	4	40025
851028	3	46	1	660	3000	4	40039
851028	7	21	1	547	1500	3	40050
851028	7	21	1	613	2500	5	40051
851028	7	21	1	620	2500	4	40053
851028	3	17	1	625	-	4	40058
851028	3	17	1	540	-	4	40059
851028	3	17	1	702	-	4	40061
851028	3	17	1	532	-	4	40062
851028	3	17	1	622	-	4	40066
851028	3	17	1	602	-	4	40071
851028	3	17	1	894	-	4	40072
851028	3	17	1	790	-	4	40073
851028	3	17	1	574	-	4	40074
851028	3	17	1	845	-	5	40078
851028	3	17	1	590	-	4	40081
851028	3	17	1	580	-	4	40082
851030	27	19	1	536	1500	3	40085
851030	27	12	1	626	2250	4	40092
851030	27	12	1	692	3250	4	40096
851030	27	9	1	542	1500	2	40101
851030	27	9	1	635	2750	4	40104
851030	27	7	1	694	3500	4	40110
851030	30	12	1	643	3100	3	40112
851030	30	12	1	720	4000	3	40113
851030	30	12	1	701	3400	4	40114
851030	30	12	1	620	2250	3	40115
851030	30	12	1	605	2250	4	40116
851030	30	12	1	735	4250	4	40117
851030	30	12	1	802	5250	4	40118
851030	30	12	1	738	4250	3	40119
851030	30	5	1	705	3800	4	40120

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
851030	30	5	1	554	1650	3	40121
851030	30	5	1	543	1650	3	40122
851030	30	5	1	585	2150	3	40123
851030	30	5	1	594	2000	3	40124
851030	27	12	1	564	1500	3	40126
851030	27	12	1	626	2500	3	40127
851030	27	12	1	530	1250	3	40132
851101	15	27	1	568	1800	4	40203
851101	15	39	1	520	1600	4	40211
851101	15	44	1	677	3550	4	40217
851101	15	44	1	538	1400	3	40218
851101	15	44	1	537	1550	3	40219
851101	15	44	1	563	1850	4	40220
851101	15	44	1	522	1300	3	40221
851101	15	44	1	675	3400	4	40224
851101	15	44	1	680	3300	4	40225
851101	15	44	1	573	2025	4	40226
851101	15	44	1	677	3250	4	40227
851101	15	44	1	612	2450	4	40228
851101	15	44	1	653	2950	4	40229
851101	15	44	1	565	1925	4	40230
851101	15	44	1	542	1550	4	40231
851101	15	9	1	628	2725	3	40232
851101	15	9	1	590	2000	3	40235
851101	15	9	1	764	5350	4	40236
851101	15	9	1	552	1650	4	40237
851101	15	9	1	620	2250	3	40238
851101	15	9	1	564	1800	3	40239
851101	15	9	1	682	3500	4	40241
851101	15	9	1	620	2825	4	40242
851101	15	9	1	628	1675	3	40243
851101	15	9	1	625	2475	3	40244
851101	15	9	1	600	1950	4	40247
851101	15	9	1	526	1300	3	40248
851101	15	9	1	523	1325	3	40249
851101	15	9	1	664	2875	2	40250
851101	15	9	1	550	1625	3	40251
851101	15	9	1	595	2175	3	40252
851104	53	17	1	628	2425	4	40256
851104	53	17	1	565	1925	3	40257
851104	53	17	1	537	1625	3	40258
851104	51	21	1	435	725	3	40260
851104	51	21	1	465	1000	4	40261
851104	51	7	1	488	1200	3	40263
851104	53	32	1	424	700	3	40264

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
851106	12	39	1	527	13250	3	40265
851106	12	40	1	644	2650	4	40269
851106	12	18	1	505	1050	2	40271
851106	12	18	1	648	2750	4	40273
851106	12	18	1	586	2050	3	40274
851106	12	18	1	566	1615	3	40277
851106	12	18	1	500	1175	3	40278
851106	12	18	1	512	1250	3	40279
851106	12	18	1	595	2150	4	40280
851106	12	18	1	582	2000	3	40283
851106	12	18	1	565	1850	4	40284
851106	12	18	1	550	1700	3	40285
851106	12	18	1	492	1060	3	40286
851106	12	40	1	675	3275	4	40288
851106	12	40	1	642	2650	4	40289
851106	12	46	1	545	1600	4	40291
851106	19	15	1	730	4475	5	40295
851106	12	46	1	417	660	3	40306
851106	12	18	1	753	2900	3	40307
851106	12	18	1	476	930	3	40308
851118	19	20	1	564	1825	4	40401
851118	19	20	1	661	2925	3	40402
851118	27	17	1	516	1280	4	40403
851118	27	17	1	596	2250	4	40404
851118	27	17	1	610	2225	4	40406
851118	27	17	1	629	2900	4	40410
851118	27	34	1	586	2015	4	40413
851205	53	27	1	556	1796	7	40422
851205	53	29	1	552	1658	4	40426
851205	51	9	1	576	2114	7	40427
851205	51	9	1	520	1482	7	40429
851205	51	9	1	574	2024	7	40430
851209	3	10	1	638	3006	4	40431
851209	3	10	1	628	2991	4	40433
851209	3	10	1	590	2463	4	40434
851209	7	18	1	758	5200	4	40439
851209	7	18	1	603	2400	4	40442
851209	3	10	1	504	1323	4	40449
851209	3	34	1	647	2640	4	40450
851210	13	30	1	607	2363	3	40461
851210	13	30	1	515	1436	4	40468
851210	13	30	1	582	1869	4	40469
851210	13	30	1	527	1441	4	40470
851210	13	17	1	578	1921	4	40474
851210	13	17	1	552	1679	4	40476

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
851210	13	17	1	573	1864	4	40477
851210	13	17	1	517	1319	4	40478
851210	13	17	1	481	1068	4	40482
851210	13	17	1	498	1342	4	40483
851210	13	17	1	518	1359	4	40485
851211	30	16	1	600	2373	4	40488
851211	30	16	1	722	3612	4	40494
851211	30	16	1	627	2913	4	40495
851211	30	16	1	625	2920	4	40496
851211	30	16	1	578	2018	4	40497
851211	30	16	1	537	1627	4	40500
851211	27	11	1	534	1540	4	40501
851211	27	11	1	556	1768	3	40502
851211	27	11	1	619	2426	7	40503
851211	27	11	1	581	2196	7	40505
851211	27	11	1	535	1685	4	40507
851211	27	11	1	534	1576	4	40508
851211	30	16	1	602	2188	4	40510
851211	30	16	1	535	1684	4	40511
851028	7	21	2	593	-	2	40000
851028	7	12	2	770	4500	4	40001
851028	7	12	2	630	2500	2	40003
851028	7	12	2	833	6250	4	40006
851028	7	12	2	768	5250	4	40007
851028	7	12	2	702	2750	4	40008
851028	7	12	2	690	3500	3	40010
851028	7	12	2	896	8500	4	40011
851028	7	12	2	622	2500	2	40013
851028	7	12	2	593	2000	2	40015
851028	7	12	2	753	4500	4	40016
851028	7	12	2	554	1000	2	40017
851028	3	15	2	625	2500	2	40019
851028	3	15	2	542	2000	4	40020
851028	3	15	2	625	2250	2	40021
851028	3	15	2	580	2250	2	40024
851028	3	15	2	580	1500	2	40026
851028	3	15	2	606	2250	2	40027
851028	3	15	2	675	3500	4	40028
851028	3	46	2	707	3500	3	40029
851028	3	46	2	773	5000	4	40030
851028	3	46	2	790	5500	4	40031
851028	3	46	2	664	2750	2	40032
851028	3	46	2	612	2000	3	40033
851028	3	46	2	640	2750	3	40034
851028	3	46	2	595	2000	3	40035

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
851028	3	46	2	595	2000	2	40036
851028	3	46	2	624	2500	2	40037
851028	3	46	2	617	2250	3	40038
851028	7	12	2	830	6250	4	40040
851028	7	12	2	785	5500	3	40041
851028	7	12	2	660	3750	2	40042
851028	7	12	2	824	6250	4	40043
851028	7	12	2	620	2500	2	40044
851028	7	21	2	800	5750	4	40045
851028	7	21	2	615	2500	3	40046
851028	7	21	2	792	6000	4	40047
851028	7	21	2	590	2000	2	40048
851028	7	21	2	575	2000	2	40049
851028	7	21	2	645	2500	2	40052
851028	7	21	2	595	2000	2	40054
851028	7	21	2	690	3250	2	40055
851028	3	17	2	525	-	2	40056
851028	3	17	2	602	-	3	40057
851028	3	17	2	700	-	2	40060
851028	3	17	2	583	-	3	40063
851028	3	17	2	792	-	4	40064
851028	3	17	2	850	-	4	40065
851028	3	17	2	745	-	4	40067
851028	3	17	2	617	-	3	40068
851028	3	17	2	774	-	4	40069
851028	3	17	2	827	-	3	40070
851028	3	17	2	770	-	4	40075
851028	3	17	2	750	-	4	40076
851028	3	17	2	648	-	2	40079
851028	3	17	2	612	-	2	40080
851030	27	19	2	638	2250	4	40084
851030	27	19	2	642	2500	4	40086
851030	27	19	2	645	2750	4	40087
851030	27	12	2	680	2750	4	40088
851030	27	12	2	700	3500	4	40089
851030	27	12	2	700	3500	4	40089
851030	27	12	2	658	2750	2	40090
851030	27	12	2	685	3000	4	40091
851030	27	12	2	595	1750	3	40093
851030	27	12	2	633	2000	2	40094
851030	27	12	2	617	2250	3	40095
851030	27	12	2	570	1650	3	40097
851030	27	12	2	666	3000	3	40098
851030	27	12	2	775	4500	4	40099
851030	27	9	2	595	1750	3	40100

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
851030	27	9	2	757	4750	4	40102
851030	27	9	2	610	2250	2	40103
851030	27	9	2	627	2150	3	40105
851030	27	7	2	702	3750	2	40106
851030	27	7	2	662	2650	3	40107
851030	27	7	2	596	1750	2	40108
851030	27	7	2	595	1850	2	40109
851030	30	12	2	648	2500	3	40111
851030	27	12	2	615	2000	2	40125
851030	27	12	2	950	9750	5	40128
851030	27	12	2	730	3800	4	40129
851030	27	12	2	797	5150	3	40130
851030	27	12	2	630	2250	3	40131
851030	27	12	2	582	1750	2	40133
851030	27	12	2	810	6250	4	40134
851030	30	41	2	920	8000	4	40135
851030	30	41	2	729	3900	4	40136
851030	30	41	2	832	5500	4	40137
851030	30	41	2	740	4000	2	40138
851030	30	41	2	744	3750	3	40139
851101	15	27	2	677	3000	3	40200
851101	15	27	2	825	6300	4	40201
851101	15	27	2	680	3100	3	40202
851101	15	27	2	787	5300	4	40204
851101	15	27	2	582	1600	3	40205
851101	15	27	2	672	2950	2	40206
851101	15	27	2	818	5750	4	40207
851101	15	27	2	782	4900	4	40208
851101	15	27	2	760	4350	4	40209
851101	15	39	2	1100	14300	4	40210
851101	15	44	2	985	11550	5	40212
851101	15	44	2	822	6150	4	40213
851101	15	44	2	753	4750	4	40214
851101	15	44	2	648	2650	3	40215
851101	15	44	2	793	5500	4	40216
851101	15	44	2	912	9225	4	40222
851101	15	44	2	638	2575	2	40223
851101	15	9	2	845	6175	4	40233
851101	15	9	2	632	2150	3	40234
851101	15	9	2	802	5500	4	40240
851101	15	9	2	948	9850	4	40245
851101	15	9	2	630	2300	3	40246
851104	53	55	2	728	3500	4	40253
851104	53	55	2	582	2025	3	40254
851104	53	17	2	800	5200	4	40255
851104	51	21	2	567	1600	3	40259
851104	51	7	2	857	6275	4	40262
851104	51	21	2	555	1550	2	40264

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
851104	51	37	2	730	3350	3	40265
851104	51	37	2	635	2750	4	40266
851106	12	39	2	840	4475	4	40266
851106	12	39	2	847	6575	5	40267
851106	12	40	2	866	6975	4	40268
851106	12	18	2	542	1400	2	40270
851106	12	18	2	992	11375	5	40272
851106	12	18	2	613	2415	3	40275
851106	12	18	2	647	2625	2	40276
851106	12	18	2	606	1780	2	40281
851106	12	18	2	582	1975	3	40282
851106	12	18	2	544	1550	2	40287
851106	12	40	2	593	2200	3	40290
851106	12	46	2	520	1275	2	40292
851106	12	46	2	962	8875	5	40293
851106	12	46	2	957	9475	4	40294
851106	19	15	2	816	6000	4	40296
851106	19	15	2	840	6375	4	40297
851106	19	15	2	1057	15125	5	40298
851106	19	34	2	807	6625	5	40299
851106	19	34	2	638	2610	3	40300
851106	19	34	2	833	6500	4	40301
851106	19	34	2	617	2325	3	40302
851106	19	34	2	750	4525	5	40303
851106	12	46	2	495	1125	2	40305
851118	19	20	2	722	4225	4	40400
851118	27	17	2	573	1780	2	40405
851118	27	17	2	757	4435	2	40407
851118	27	17	2	594	1775	2	40408
851118	27	17	2	880	8100	5	40409
851118	27	34	2	532	1350	2	40411
851118	27	34	2	819	5710	4	40412
851118	27	34	2	516	1225	2	40414
851205	53	32	2	386	532	2	40420
851205	53	55	2	538	1421	2	40421
851205	51	37	2	669	2988	2	40423
851205	45	29	2	593	2210	5	40424
851205	45	29	2	549	1679	3	40425
851205	51	9	2	616	2165	2	40428
851209	3	10	2	622	2595	3	40430
851209	3	10	2	717	4431	4	40432
851209	3	10	2	585	2060	2	40435
851209	7	18	2	800	6475	5	40436
851209	7	18	2	922	10180	6	40437
851209	7	18	2	808	6050	6	40438

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
851209	7	18	2	795	6225	6	40440
851209	7	18	2	672	3350	4	40441
851209	7	18	2	594	1980	1	40441
851209	7	18	2	548	1460	2	40443
851209	7	18	2	549	1420	2	40444
851209	7	18	2	596	2003	2	40445
851209	7	18	2	518	1350	2	40446
851209	7	55	2	696	2651	5	40447
851209	7	55	2	691	3264	5	40448
851209	3	34	2	695	3890	4	40451
851209	7	33	2	635	2775	5	40452
851209	7	33	2	537	1385	2	40453
851209	7	18	2	682	2460	2	40454
851209	7	18	2	653	2780	3	40455
851209	3	50	2	701	3952	4	40456
851209	7	55	2	580	1944	2	40457
851210	13	30	2	789	5430	2	40460
851210	13	30	2	694	3010	2	40462
851210	13	30	2	667	3238	4	40463
851210	13	30	2	633	2310	2	40464
851210	13	30	2	582	1981	2	40465
851210	13	30	2	526	1285	2	40466
851210	13	30	2	572	1798	2	40467
851210	13	30	2	476	916	2	40471
851210	27	47	2	804	7210	5	40472
851210	13	17	2	586	1843	2	40473
851210	13	17	2	607	2104	2	40475
851210	13	17	2	662	2472	2	40479
851210	13	17	2	533	1376	2	40480
851210	13	17	2	576	1589	2	40481
851210	13	48	2	748	4460	5	40484
851211	30	16	2	902	10050	6	40486
851211	30	16	2	619	2322	2	40487
851211	30	16	2	597	1904	2	40489
851211	30	16	2	577	1835	2	40490
851211	30	16	2	795	6820	5	40491
851211	30	16	2	774	4824	3	40492
851211	30	16	2	808	6000	5	40493
851211	30	16	2	572	1846	2	40498
851211	30	16	2	578	1917	2	40499
851211	27	11	2	586	1978	2	40504
851211	27	11	2	568	1770	2	40506
851211	27	11	2	530	1442	2	40509

Appendix table 3 (cont'd)

DATE	SITE	DEPTH	SEX	LENGTH	WEIGHT	MATURE	NO.
851211	27	50	2	936	10150	5	40512
851211	27	49	2	627	2340	2	40513
851211	30	34	2	728	4752	2	40515
851211	30	34	2	719	3610	3	40516
851211	30	34	2	748	4500	2	40517
851211	30	34	2	565	1775	2	40518
851211	30	34	2	542	1461	2	40519
851211	30	34	2	634	2391	2	40520

Appendix table 4. Codes used in Appendix Table 3 to describe maturity conditions during a lingcod research hook and line survey of the Gulf Island region (Statistical Area 17) of the Strait of Georgia, October 28-December 12 1985.

A. LINGCOD

Codes used to describe lingcod maturity stages, modified from Cass et al. 1984.

	MATURITY CODE	GONAD CONDITION
	0	unknown
	1	immature; (males stringlike; females small)
	2	immature; (males flat, transparent and slightly enlarged; females, slightly enlarged)
females	3	ova are semi-transparent and less than 1 mm in diameter, ovaries fills one-third of the body cavity
	4	ova are opaque and about 1 mm in diameter, ovaries fill two-thirds of the body cavity
	5	ova are less than 2 mm in diameter, ovaries fill 80% of body cavity
	6	ova are about 2 mm in diameter
	7	ripe (ova are larger than 2 mm in diameter, ovaries visibly fill and distend body cavity)
	8	spent (ovary may be bloodshot and purple in colour, ovary is flaccid and about one-third to two-thirds of the body cavity)
	9	resorbing (ova are large to opaque and degenerative)
	10	recovering (ovaries returning to pre-ripening stage (code 3) ovaries are firm and fill less than half the body cavity, ova are small)
	11	resting (ovaries fill less than one-third of the body cavity, no ova present)
males	3	testes enlarged, filling less than one-quarter of the body cavity and white to brown in colour
	4	testes enlarged to two-thirds of the body cavity, cross-sections of the gonad will produce milt
	7	ripe (testes are large and full of milt)
	8	spent (testes are flaccid, reduced in size and may contain some milt)
	11	resting (testes are less than one-third of the body cavity, usually brown in colour and devoid of milt

Appendix table 4 (cont'd)

B. ROCKFISH

Codes used to describe rockfish maturity stages, from Nagtegaal and Farlinger (1980) and Westrheim (1975).

MATURITY	CODE	GONAD CONDITION
	0	unknown
	1	immature (translucent; males, stringlike; females, small)
females	2	mature (small, yellow eggs; translucent or opaque)
	3	mature (large, orange-yellow eggs; opaque)
	4	fertilized (large, orange-yellow eggs; translucent)
	5	embryos or larvae (include eyed eggs)
	6	spent (large, flaccid, red ovaries. a few larvae may be present)
	7	resting (moderate size, firm, red-grey ovaries)
	8	resorbing
males	2	maturing (stringlike, translucent, white)
	3	developing (swelling, brown-white)
	4	developed (large, white; easily broken)
	5	running (running sperm)
	6	spent (flaccid, red)
	7	resting (ribbon-like; small, brown)